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Student Spotlight on Research Proceedings

SUNY College of Environmental Science and Forestry

Student Spotlight on Research Proceedings

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Gateway Center

Syracuse, NY

ESF

State University of New York
College of Environmental Science and Forestry

Members of the Ad Hoc Committee for the Student Spotlight on Research:

Mr. John Wasiel
Ms. Ellen Edgerton
Ms. Theresa Kaier-May

The Spotlight is organized by the Ad-Hoc Committee for Spotlight on Student Research, a sub-committee of the Academic Governance Committee on Research (COR). The Committee would like to thank the Office of Research Programs for sponsoring the refreshments during the poster session.

We would also like to express our gratitude to the graduate students, undergraduates, and faculty for contributing to this event. Without your work there would be no event!

GRADUATE STUDENT ABSTRACTS

Authors: Jech, S. and Teece, M. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Microbial biomarkers and the growth of unusual freshwater microbialites in a Central New York lake

Abstract: Green Lakes State Park in Fayetteville, NY hosts a unique freshwater 'coral' called a microbialite. These are calcium carbonate structures made by bacteria, which are related to the oldest known form of life on Earth. However, little is known about these rare structures, which potentially have a lot to tell us about how life evolved on Earth. This work uses gas chromatography-mass spectrometry to identify and quantify lipid biomarkers that the organisms in the microbialites produce. Hopanoids, in particular, are useful biomarkers. Five hopanoids were quantified in samples from Green Lake State Park and their concentrations were compared at different depths in the lake. Additionally, it was determined that the microbialites that grow directly on wood and debris that fall into the lake have a different hopanoid composition than the shelf-like microbialite that grows directly along the shore.

Level of research: Graduate - M.S.

Department: Chemistry

Faculty Advisor: Mark Teece

Authors: Madhuri Dinakar, Dept. Environmental Resources Engineering State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

Adrienne Phillips, Dept. of Chemistry, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

Joel Requena, Dept. Environmental Resources Engineering State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Plastics in the waste stream: are bioplastics better?

Abstract: Plastics manufacturing is the third largest industry in the United States. Conventional plastics accumulate in the environment due to their densely-packed hydrocarbon chains that make them slow to degrade. In nature, this degradation process involves microorganisms that break the carbon-carbon bonds of the hydrocarbon chains in the plastic material. These high-energy bonds are difficult to break, and require UV light or high heat.

To accelerate their degradation and reduce chain density, conventional plastics have been modified to contain additives. But even with additives, these chains cannot rapidly break down to completion. More recently, a new type of plastics, called bioplastics, are being produced. These have many of the thermal properties as conventional plastics, but their hydrocarbon chains contain ester bonds. These ester bonds are rapidly degradable by microbes, and be synthesized by microbes too. Two common types of bioplastics are polyhydroxyalkanoates (PHAs) and polylactic acids (PLAs). This review focussed on the benefits and complications of bioplastics.

Bioplastics degrade completely into renewable organic matter. Aerobic conditions are optimal for this process to occur. However, due to the lack of clear distinction between bioplastics and conventional plastics in the municipal waste stream, they are typically mixed together and ultimately end up in landfills, where anaerobic decomposition causes the same harm as conventional plastics. Thus, for bioplastics waste to be successfully managed, our current recycling infrastructure and sorting methods need to be modified to accommodate them.

Level of research: Graduate - M.S.

Department: Chemistry

Faculty Advisor: Doug J. Daley

Authors: Derminio, D.S., Boyer, G. L. Departments of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Impacts of Hydrogen Peroxide on the Growth of Cyanobacteria and Chlorophytes

Abstract: Algal blooms are increasing on a worldwide scale. This includes cyanobacteria blooms that produce toxins that impact recreation, human, and ecosystem health. Hydrogen peroxide (H2O2) has been proposed as a control method to limit the growth of these cyanobacteria blooms. Here, the sensitivity of different species of cyanobacteria and chlorophytes to H2O2 was examined. Cyanobacteria in the genera *Anabaena, Microcystis*, and *Planktothrix* and chlorophytes in the genera *Chlorella*, *Chlamydomonas*, and *Scenedesmus* were grown in Z8 media using a 12:12 light:dark cycle at 22oC with the addition of various concentrations of H2O2. In vivo fluorescence, catalase activity, and toxin production were measured at the beginning and end of each experiment. Different species, even within the same genus, reacted differently to the addition of H2O2. This suggests the use of H2O2 to control harmful cyanobacterial blooms must carefully consider which genera and species are present.

Level of research: Graduate - Ph.D.

Department: Chemistry

Faculty Advisor: Greg Boyer

Authors: Lam, K., Schwid, A., Dibble, T., Department of Chemistry, SUNY-ESF, Syracuse, NY 13210

Title: Computational Study of the Fate of a Previously-Unknown Intermediate in the Atmospheric Oxidation of Mercury

Abstract: Mercury oxidation in the atmosphere limits the rate of mercury transfer from the atmosphere to ecoystems. Global models of atmospheric mercury oxidation have indicated BrHgONO to be a significant Hg(II) species. BrHgONO has been predicted by quantum chemical calculations to photolyze rapidly to produce BrHgO and NO. BrHgO radical has never been detected in the laboratory, although previous calculations suggested the species to be thermally stable.

We used computational chemistry to evaluate reactions of BrHgO with atmospherically abundant species CH4, NO, and NO2.

$BrHgO\cdot + CH_4 \rightarrow BrHgOH + \cdot CH_3$ (1)

$BrHgO\cdot + NO \rightarrow BrHgONO$ (2)

$BrHgO\cdot + NO_2 \rightarrow BrHgONO_2$ (3)

Preliminary kinetic calculations for the hydrogen abstraction from CH4 (reaction 1) suggested a fast reaction, corresponding to a lifetime of 0.7 s with respect to forming BrHgOH at ground level (298 K, 1 atm). Our preliminary result (using the M06-2X functional with a triple-zeta basis set), however, overestimated the rate constant for the analogous reaction of $OH + CH_4 \rightarrow HOH + CH_3$; therefore, the true rate constant for the reaction of BrHgO would be smaller than the reported value. The fast hydrogen abstraction from CH4 further suggested the kinetics of hydrogen abstractions from other organic compounds with weaker C-H bonds (e.g. C2H6, HCHO) to be atmospherically significant.

BrHgO radical may reform BrHgONO (reaction 2) or produce the thermally stable BrHgONO2 (reaction 3) by reacting with NO or NO2, respectively. Their reactions may be significant fates to BrHgO in regions heavily impacted by vehicle and industrial emissions.

Our work contributes to the identification of gaseous oxidized mercury (GOM) species in the bromine-initiated oxidation of mercury, and thereby helps improve models of the mechanism, aid laboratory scientists in designing kinetic and mechanistic experiments, and contribute to identifying GOM species in field work. Ultimately, this will improve our understanding of mercury cycling in ecosystems.

Level of research: Graduate - Ph.D.

Department: Chemistry

Faculty Advisor: Ted Dibble

Authors: Dieter Scheibel, Ivan Gitsov

Michael M. Szwarc Polymer Research Institute & Department of Chemistry

State University of New York ESF

Syracuse, NY 13210

Title: Synthesis of Fluorescent Water Soluble Tyrosine Copolymers via Environmentally Friendly Enzyme Mediated Polymerization for Use in Biomedical Applications

Abstract: Enzymes are continually being pursued as catalysts in numerous syntheses due to their ability to mediate reactions with high stereo- and regiospecificity. Enzymes are also notable for their lack of byproducts and usability in aqueous medium making them highly regarded as "green" catalysts. In this study the enzyme laccase complexed with a linear-dendritic, linear-hyperbranched, or linear-linear complexing agents is used to copolymerize tyrosine with 7-hydroxycoumarin, o-hydroxycinnamic acid, or bis-dimethoxycurcumin via a "quasi-living" environmentally friendly reaction.

Polymers synthesized in this study are fluorescent in water and retain high quantum efficiencies similar to those of the monomers utilized (Φ = 0.8, 7-hydroxycoumarin; Φ = 0.7, poly(tyrosine-co-7-hydroxycoumarin)). The polymers investigated also display interesting composition dependent solution behavior. As poly(tyrosine) has previously shown high biocompatibility, the current polymers show promise to serve in biomedical applications such as in drug delivery and as bio-imaging agents.

Of significant interest to the scientific community, living polymerizations afford precision control in molecular mass and defined end-group functionality. Utilizing a "quasi-living" polymerization setup, the described reaction system will be of interest to a wide audience by allowing facile control of polymer molecular mass and architecture. Development and further refinement of this interesting and innovative method of copolymerization will allow for the production of advanced materials for multidisciplinary use. Future studies look to investigate the incorporation of additional monomers and to examine the efficacy of the synthesized polymers in vitro.

Level of research: Graduate - Ph.D.

Department: Chemistry

Faculty Advisor: Ivan Gitsov

Authors: Smith, Z.J. and Boyer, G.L., State University of New York College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY, 13210, USA.

Title: Monitoring for Paralytic Shellfish Toxins in the Great Lakes: Challenges and Improvements

Abstract: Historically, the class of cyanotoxins called the Paralytic Shellfish Toxins (PSTs) received most attention in marine environments. Due to recent detection of PSTs in US freshwater, it has become important to better understand PST prevalence in inland waters. For this reason, cyanotoxin monitoring in Lake Erie has begun to include Paralytic Shellfish Toxins (PSTs). Several analytical methods for PSTs are viable for monitoring programs including (1) chemical oxidation with HPLC and detection by fluorescence, (2) HPLC with mass-spectrometric detection (MS), and (3) PST ELISA. Samples from a New York State lake monitoring program covering 100 lakes were analyzed for PSTs using an HPLC-Fluorescence system. From the larger group samples a subset were then subsequently analyzed by MS and ELISA. The effectiveness and viability for the use of one of, or a combination of, the three methods for freshwater PST monitoring programs will be presented.

Level of research: Graduate - Ph.D.

Department: Chemistry

Faculty Advisor: Greg Boyer

Authors: Bofan Wei; Gregory L. Boyer. Departments of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Detection of Phototransformation product of Cyanobacterial Hepatotoxin Microcystin-LR by NMR and LC/MS

Abstract: Toxic cyanobacterial blooms are a growing environmental and human health concern. The most commonly occurring toxins produced by cyanobacteria are microcystins (MCs). This toxin affects the liver by forming a permanent covalent linkage with the enzyme protein phosphatase. Among the microcystins, microcystin-LR (MC-LR) is found to be one of the most abundant and the most toxic. It is thus necessary to develop effective treatment methods to remove microcystin-LR from contaminated water. Photodegradation is a very important way to remove contaminants in natural water system. Since the defined absorption band of MC-LR in the UV range has a maximum at 238 nm, we might expect the removal of MC-LR under UV irradiation. To prove our hypothesis, we use 800MHz 1H NMR to identify the structure of standard MC-LR and the product after UV irradiation. The results shows that when microcystin-LR was exposed to UV, two new compounds were identified as [4(E), 6(Z)-Adda]- and [4(Z), 6(E)-Adda] microcystin-LR and they were produced in equal amount. Since the photoproducts have the same molecule weight with MC-LR, the HPLC method we use right now cannot separate them.

So, nine different types of HPLC columns were used to separate photoproducts with MC-LR and we got totally different performance among them.

Level of research: Graduate - Ph.D.

Department: Chemistry

Faculty Advisor: Greg Boyer

Authors: Yuting Zhu, David. J. Kieber

Title: Sunlight-induced Production of Carbonyl Compounds in the North Pacific Ocean

Abstract: Low molecular weight (LMW) carbonyl compounds are ubiquitous, oxygenated volatile organic compounds (OVOCs) in the troposphere that are important in the oxidative capacity in the atmosphere and secondary organic aerosol formation. The sea to air flux is a potentially significant source of several LMW carbonyls to the lower atmosphere, but parameterization of these fluxes has been hindered by a poor understanding of carbonyl cycling in seawater. Although it is considered an important source, the photochemical production of carbonyl compounds in seawater is not well studied. In this study, photochemical efficiencies (AQYs) were determined for the production of acetaldehyde, glyoxal and methylglyoxal in seawater from several stations in the north Pacific Ocean employing a monochromatic irradiation system based on a 1000 W Xenon lamp. Wavelength dependent AQYs decreased exponentially with increasing wavelength (290-400 nm) at 20 ˚C. AQYs decreased after 6 h of irradiation at 310 nm, possibly due to a depletion of photochemical precursors or carbonyl photolysis. Temperature dependent activation energies (average ±95% CI) for the photochemical production at 320 nm were 5.6 (±6.2), 16.0 (±5.1), and 21.0 (±9.2) kJ mol-1 for acetaldehyde, glyoxal and methylglyoxal, respectively. AQY spectra can be used to determine regional-scale photochemical fluxes for these compounds in the surface ocean. For the north Pacific Ocean, our estimated photoproduction rates were 3.6-6.0 nmol L-1 d-1 and 0.3-1.2 nmol L-1 d-1 for acetaldehyde and glyoxal, respectively under cloudless conditions in August. The importance of these findings in the oceanographic and atmospheric aspects for the cycling of carbonyl compounds will be discussed.

Level of research: Graduate - Ph.D.

Department: Chemistry

Faculty Advisor: David J. Kieber

Authors: Vernon Coffey

Title: Quantifying experimenter bias in percent cover assessment

Abstract: I would like to invite visitors to the Spotlight to participate in a research project. Participants would view a poster size visual representation of a forest floor and submit their estimation (on their phone or the provided laptop) of the percent cover of elements representing forest vegetation. This simulates a commonly used method for quantify an aspect of forest structure in ecological studies. I will analyze the data for presentation at a future event such as this one.

Level of research: Graduate - M.S.

Department: EFB

Faculty Advisor: Dr. Powell

Authors: Hummel, D. L., Ringler, N. H. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Fish assemblages and their relationship to habitat structure in a newly remediated urban lake

Abstract: Centuries of municipal and industrial pollution resulted in mandated remediation of Onondaga Lake, a medium-sized urban Lake within the city limits of Syracuse, NY. Physical manipulation and removal of mercury in the western and southwestern remediation zones were nearly completed by the fall of 2016. The new benthic substrate in remediated areas currently lacks habitat complexity that is critical for fish feeding and spawning. The objectives of this research are to assess the fish assemblages surrounding existing and newly implemented habitat structure in the littoral area of the Lake and to evaluate sampling methods for future assessment. Sampling will occur May- October 2017. Data will be collected using multiple techniques: GoPro footage, gill netting and boat electro-fishing. Fish species diversity will be compared between basins and by structure type. This research will provide necessary data on fish assemblages and their relationship to surrounding habitat structure prior to the addition of more than 1,000 new habitat structures. We hypothesize that the addition of structure and habitat complexity in remediated areas will one day match or exceed the diversity in fish assemblages of undisturbed areas of the Lake.

Level of research: Graduate - M.S.

Department: EFB

Faculty Advisor: Neil H. Ringler

Authors: Patterson, T.R. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Horton, T.R. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Improving pitch pine restoration outcomes in the Albany Pine Bush Preserve using ectomycorrhizal fungi

Abstract: Pitch pine restoration in the Albany Pine Bush Preserve has not been successful in all areas of the preserve despite the removal of black locust. The invasive black locust and native pitch pine associate with different groups of mutualist soil fungi on their roots.

My hypothesis for the failure of restoration in some areas is the lack of compatible mycorrhizal fungi in the soil where restoration has been less successful. Research by my advisor and others show that a lack of fungal partners of pine can hinder their establishment. Providing seedlings with fungal inoculum in the form of spores or live soil should improve the restoration outcomes in the Albany Pine Bush Preserve. To this end, I propose two objectives:

Objective 1: Investigate fungal communities present in three site types: black locust stands, recently restored areas, and non-invaded mature pitch pine stands. The roots of seedlings grown in these soils will be examined to determine what mycorrhizal fungi are present in each site.

Objective 2: Experimentally introduce critical fungal partners to new pine seedlings in sites with previously low restoration success to determine if pine seedling establishment is improved by reintroduction with their local fungal partners.

Level of research: Graduate - M.S.

Department: EFB

Faculty Advisor: Thomas Horton

Authors: Pershyn, C.E., Ringler, N.H., and Murphy, M.H. Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Brook Trout Presence and Community Composition of the East Branch Ausable River, NY

Abstract: In most New York watersheds, the distribution of Brook Trout (*Salvelinus fontinalis*) is confined to headwater streams and groundwater-fed streams and ponds. From 2014 to 2016, 33 tributaries were sampled using backpack electrofishing surveys, from the headwaters of the East Branch Ausable River to the confluence with the West Branch 28 miles downstream to examine fish community composition and

the presence of Brook Trout. Streams were sampled near the confluence with the river, and Brook Trout were present in 23 of these sites. Trap net surveys of Upper Ausable Lake showed abundant Brook Trout and 11 additional native species. Fish community composition will be compared to historical surveys within the watershed; comparisons of Brook Trout presence to landscape and local scale habitat, land use, and water quality data will be examined. Results suggest that brook trout populations are self-sustaining in East Branch tributaries. The presence of juvenile brook trout suggest that the streams are serving as quality nursery habitat, though further examination of brook trout juvenile and adult distribution brook trout juvenile and adult distribution in the main stem and tributaries of the East Branch is needed

Level of research: Graduate - M.S.

Department: EFB

Faculty Advisor: Neil H Ringler

Authors: Stieber, E.G. (1), A.J. Smith (2), B.T. Duffy (2), N.H. Ringler (1), M.K. Fierke (1) and J.L. Lojpersberger (2)

(1) Department of Environmental Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

(2) New York State Department of Environmental Conservation, Troy, NY 12180

Title: Evaluating a provisional macroinvertebrate lake Index of Biotic Integrity: Potential drivers of macroinvertebrate community dynamics and water quality in lakes across New York

Abstract: The assessment of freshwater systems is becoming increasingly important with growth and expansion of the human population. Increased areas of agriculture, housing developments, and urban expansion has led to increased levels of total nitrogen and phosphorus, high levels of specific conductance, and loss of habitat in aquatic ecosystems. These altered systems can have detrimental effects on organisms associated with them. Macroinvertebrates are common biological indicators (bioindicators) used in aquatic systems. They are inexpensive to sample, are mostly immobile, and can be highly sensitive to pollution, making them adequate focal organisms for monitoring the quality of freshwater. A study was done to evaluate and establish an Index of Biotic Integrity (IBI) in New York lakes using macroinvertebrates. Using methods and metrics adapted from a study done by the Stream Biomonitoring Unit (SBU) of the New York State Department of Environmental Conservation (NYSDEC) in 2008, an additional dataset was collected and analyzed in 2016. Lakes were classified by alkalinity, conductivity, and percent natural cover values. The dataset included 51 lakes across New York: 20 “reference condition” lakes and 31 “test” lakes. Composite, littoral zone samples were taken at eight locations at each lake. Water chemistry, shoreline disturbance, and physical habitat data were collected.

Macroinvertebrates were identified to lowest taxonomic level possible. Benthic macroinvertebrate community dynamics, land use, and potential drivers of the IBI were evaluated. The 2016 dataset was compared to the provisional (2008) dataset and significant metrics were chosen for future sampling and evaluation of water quality in New York lakes.

Level of research: Graduate - M.S.

Department: EFB

Faculty Advisor: Neil Ringler

Authors: Carolyn T. Chang, Brooke M. Clemons, Christopher M. Whipps

Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY 13210 USA

Title: Can strain typing help us understand *Mycobacterium marinum* outbreaks at zebrafish research facilities?

Abstract: Mycobacteriosis is a common pathogen found in laboratory zebrafish (Danio rerio). It is caused by several species and strains of *Mycobacterium* spp. The manifestation of mycobacteriosis is species-specific ranging from chronic, low-level infections lacking outward signs of disease to more acute, severe infections causing high levels of mortality and morbidity. *Mycobacterium marinum* is one species of particular interest because it does result in severe outbreaks and it is also occupational health hazard as it can cause skin infections in human (e.g. fish handler's disease or fish tank granuloma). Transfer of zebrafish lines between research facilities is a common practice that has been identified as a biosecurity risk for the transmission of mycobacteriosis. In order to better understand *M. marinum* outbreaks in zebrafish facilities and establish potential epidemiological linkages existing between facilities, we conducted strain typing of 30 M. marinum strains isolated from outbreaks in 7 different facilities located throughout the United States. Strain typing was carried out through a variable number of tandem repeat (VNTR) assay using four VNTR loci followed by a cluster analysis. Results show that isolates from similar geographic locations group together, with isolates sharing similar VNTR repeat values. The addition of detailed facility history including record of fish transfer may help to provide further insight into the grouping of isolates. Further use of VNTR strain typing of *M. marinum* isolates from outbreaks, along with a facility history, may help identify additional epidemiological linkages between outbreaks increasing our understanding of the transmission of mycobacteriosis between facilities.

Level of research: Graduate - Ph.D.

Department: EFB

Faculty Advisor: Christopher M. Whipps

Authors: Justine E. Weber (1), Donald J. Leopold (1), and John J. Wiley, Jr. (2)

(1) Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

(2) U.S. Fish and Wildlife Service, New York Field Office, Cortland, NY 13045

Title: Greenhouse germination trials with federally-listed Houghton's goldenrod: Evaluating factors associated with population persistence

Abstract: Houghton's goldenrod (*Oligoneuron houghtonii*) is a Great Lakes endemic limited to a small region along the Niagara Escarpment, with approximately 80 populations in Michigan and Ontario, and one in western New York. The species is federally-listed as threatened, state-listed as threatened in Michigan and endangered in New York, and is a species of concern in Canada. While generally rare, there may now be enough protected populations to meet the federal recovery criterion, and it may be appropriate to consider Houghton's goldenrod for delisting from federal protection. However, more data are needed regarding long-term trends related to persistence. As part of a broader study on population stability, greenhouse experiments were performed to evaluate the effects of moisture and substrate on germination success. Seeds were collected from 27 populations and cold-moist stratified for approximately 120 days. Each population was exposed to six substrate treatments (control [potting soil], sand, marl, gravel, litter, moss) and four moisture treatments (volume [high and low] x frequency [high and low]). Binomial mixed models were used to test for differences in germination rates between treatments, with population as a random effect. Germination rates on smoother substrates were significantly higher ($p < 0.001$) than germination rates on rougher substrates. The effects of water volume and frequency were not independent (interaction significant, $p < 0.001$), and the simple effects of low volume and infrequent moisture drove significantly lower germination rates. These results will be combined with field data to estimate population stability (i.e. likelihood of persistence) across *O. houghtonii*'s range.

Level of research: Graduate - Ph.D.

Department: EFB

Faculty Advisor: Donald J. Leopold

Authors: Bhatti, S.J., Kroll, C.N. Departments of Environmental Science and Environmental Resources and Forest Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Drought Prediction in the Indus River Basin

Abstract: The Indus River Basin is located in South Asia and is a source of fresh water for millions of people living in Pakistan. It also supports a wide variety of habitats and houses diverse species due to its unique topography. The Indus River originates in Karakoram, Himalayas and the Hindu Kush Mountains and is fed by precipitation and melting glaciers (Archer, 2002). This study aims to estimate low streamflow statistics for the Indus River Basin, which are needed for water resource planning and management purposes. It is generally recommended to use a historic streamflow record of at least 20 years to estimate low streamflow statistics, but for many sites on the Indus River Basin either the record is shorter than this or it is ungauged. For this reason, a hydrologically similar regional of streamflow sites outside of Pakistan will be used to develop appropriate low streamflow estimation methodology, and then this methodology will be employed for sites within the Indus River catchment. The catchment characteristics for selecting hydrologically similar sites will include precipitation, temperature, drainage basin area, drainage density, elevation, slope, aquifer soil type, land use and stream order. Regional regression will then be used develop a model for low streamflow as a function of these characteristics. In addition, data transfer techniques, where a long-record site within the region is used to transfer information to a shorter record site, will used to estimate low streamflows, and this method will be compared to regional regression.

Level of research: Graduate - M.S.

Department: Environmental Science

Faculty Advisor: Charles N. Kroll

Authors: Daniel S. Hong. SUNY College of Environmental Science and Forestry, B9 Marshall Hall, 1 Forestry Drive, Syracuse, New York 13210

Adam D. Wild. SUNY Cobleskill, 215 Center for Agriculture & Natural Resources, 114 Rockland Lane, Cobleskill, NY 12043

Ruth D. Yanai. SUNY College of Environmental Science and Forestry, B9 Marshall Hall, 1 Forestry Drive, Syracuse, New York 13210

Title: Battle of the Babies: Beech Interference with Maple Regeneration

Abstract: Beech bark disease is a pathogenic complex that causes decline and mortality of American beech (*Fagus grandifolia*) in northern hardwood ecosystems. Under stress, American beech produces root sprouts. As a result, aftermath stands have a (high density of) dense population of small beech in the understory, which interferes with regeneration of more valuable species, such as sugar maple (*Acer saccharum*). The purpose of this study was to investigate beech interference with maple regeneration in

26 forest stands in the White Mountains of central New Hampshire. Different size-class beech and sugar maple were inventoried in 1994, 2003, and 2012 in 13 of the stands and in 2004, 2010, 2011, and 2015 in the other 13 stands. We compared the densities of beech germinants, seedlings, saplings, and overstory trees to those of sugar maple as a function of stand age(succession stage?), soil chemistry, and bedrock type. There were fewer germinants of both beech (P=0.06) and sugar maple (P=0.04) in stands with high net nitrogen mineralization. The number of juvenile beech declined with increasing soil extractable calcium (P=0.04). High soil calcium is important to the health of sugar maple. Understanding these influences could lead to better management of beech and the species that compete with it in the context of the continuing spread of the invasive disease complex.

Level of research: Graduate - M.S.

Department: Environmental Science

Faculty Advisor: Ruth D. Yanai

Authors: Slodysko, K.N., and Boyer G.L., State University of New York College of Environmental Science and Forestry

Title: Microcystin in Fish Tissue: A Potential Risk to Consumers?

Abstract: Microcystins (MCs), a class of cyclic heptapeptide toxins produced by cyanobacteria, present a variety of risk factors to consumers. While the risk of exposure to MCs through drinking water is well characterized, less is known about fish consumption as an exposure pathway. The WHO has established a tolerable daily intake (TDI) for the public of 0.04 µg MC-LR per kilogram of body weight. It is unknown if fish from lakes with blooms would contain amounts of MCs exceeding the 0.04 µg TDI. Lake Champlain has a documented history of cyanoblooms especially in embayments like Missisquoi Bay. Muscle and liver tissues were collected from three Lake Champlain fish species. An extraction and purification method was developed and coupled with LC-MS/MS to test for MCs. Internal standard recoveries were 89%±11%. This method will be utilized to assess MC concentrations of fish sampled from Lake Champlain.

Level of research: Graduate - M.S.

Department: Environmental Science

Faculty Advisor: Boyer

Authors: Lin, J; Kroll, C.N. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Sensitivity analyses of air pollution removal provided by i-Tree Eco

Abstract: The dry deposition module of i-Tree Eco (www.itreetools.org) can estimate air pollutant removal by urban trees for O3, SO2, NO2, CO and PM2.5. These estimates are typically based on forest inventory plots, pollution concentration, and meteorological data. While i-Tree Eco has been extremely beneficial to the planning and management of urban trees, it has limitations. The model makes assumptions that simplify the function of urban forests and the representation of urban landscapes. Several studies indicate that while these tools are useful, quantifying the uncertainty of model output should be addressed. This study focuses on a sensitivity analysis of i-Tree Eco, and assesses how the uncertainty in model output can be apportioned to different sources of uncertainty in model input. The specific goals of this study are to: (1) investigate the effect and efficiency of different sensitivity methods applied to i-Tree Eco; (2) identify input variables that have negligible effects, linear and additive effects, non-linear or interaction effects, and threshold effects on model output; and (3) explore interactions between input variables and assess the impact of these interactions on the dry deposition estimates from this tools.

Level of research: Graduate - Ph.D.

Department: Environmental Science

Faculty Advisor: Charles Kroll

Authors: Nyelele, C., Kroll, C.N. Departments of Environmental Science and Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Ecosystem services and MillionTreesNYC

Abstract: Trees provide ecosystem services such as air pollution removal, carbon storage and sequestration, urban heat island reduction, storm water runoff reduction as well as other unquantifiable socio-economic benefits. With large-scale plantings being undertaken in many cities to increase tree canopy coverage as well as the health, economic and environmental benefits that come with trees, there is need to assess the extent to which trees provide these ecosystem services, where services are realized, whether benefits are distributed equitably and most importantly to improve methods of determining future planting locations. This study seeks to assess the current and future ecosystem benefits of New York City's recent planting initiative in Bronx, NY for five snapshots in time (2001, 2006, 2011, 2015 and 2025). Land cover and tree canopy estimates for 2001-2015 are derived from classification of high resolution images of the borough. i-Tree (www.itreetools.org) tools are used to

determine the benefits of trees in each census block group for each analysis period. Change analysis is then carried out at the census block group level to determine the magnitude and direction of change for each ecosystem service over time. A grow-out scenario based on urban tree database information and allometric equations is used to predict future canopy estimates and ecosystem services. Results of this study will help assess the benefits of new tree plantings and help inform where and how tree plantings should be increased in the future by considering trade-offs between multiple ecosystem services provided by trees.

Level of research: Graduate - Ph.D.

Department: Environmental Science

Faculty Advisor: Charles N. Kroll

Authors: Kruegler, J, Endreny, TA. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Exploring the Effects of Riparian Vegetation Density on Reach Scale Hyporheic Exchange

Abstract: Hyporheic exchange is the mixing of surface water and groundwater below a river bed due to pressure gradients, and it facilitates biogeochemical transformations that improve the water quality of rivers. The Networks with EXchange and Subsurface Storage (NEXSS) model was developed by the USGS to predict exchange at the reach scale, using a monotonic lateral pressure gradient between the valley and river bed, while ignoring water table depressions caused by riparian evapotranspiration and their effect on reversing hyporheic flow paths. This research first uses the spatially explicit MODFLOW groundwater model to simulate multiple scenarios of increasing riparian density and water table depression, starting with none, in order to determine the impact of depressions on reach scale hyporheic exchange flux metrics such as flux rate, path length, and direction. The research next proposes a modification to the NEXSS model to represent a non-monotonic valley water table. This altered NEXSS model will produce hyporheic exchange values that can be compared to values from the unaltered model to highlight the effects of riparian vegetation density on reach scale hyporheic exchange.

Level of research: Graduate - M.S.

Department: ERE

Faculty Advisor: Theodore A. Endreny

Authors: Morrison, R., Endreny, T. Department of Environmental Resource Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: The Role of Megacity Tree Cover in Mitigating Stormwater Flow and Water Quality

Abstract: Urbanization leads to the removal of permeable land and tree cover, which reduces infiltration and evapotranspiration and thereby increases stormwater runoff volume, pollutant loads to receiving water, and reduces evapotranspiration and cooling of air temperature. This research examines the role of tree cover in reducing stormwater volume and loads for a group of the world's largest cities called megacities, defined as having 10 million or more residents. The methods involved simulating the water and energy balance with i-Tree Hydro for two scenarios, a base case of existing tree cover and an alternative case of potential tree cover. Aerial photos of each megacity were sampled using supervised classification in 10 grids for a total area of 2.5 km2 in order to obtain land cover, and then local elevation, soil, and weather data were obtained and pre-processed. The outputs of this analysis will be a comparison of the stormwater flows and how they change by running an alternative simulation that theoretically increases tree cover to mitigate the urban stormwater and reduce flow and increase water quality.

Level of research: Graduate - M.S.

Department: ERE

Faculty Advisor: Theodore Endreny

Authors: T. Endreny

Title: Determining Bankfull and Non-bankfull Parameters Using Downstream Hydrologic Geometry

Abstract: Hydraulic complexity is defined by velocity gradient spatial patterns, and it has been used to identify species habitat zones and explain patterns in species richness within river networks. This research tests if a downstream hydrologic geometry (DHG) bankfull model combined with observed river channel widths can generate accurate estimates of channel depth at bankfull and non-bankfull stages, in the Rio Negro (RN) and Rio Solimoes (RS) confluence. The DHG model used river basin area as an explanatory variable to predict bankfull discharge, cross-sectional (XS) area, width and depth. The observed bankfull channel widths came from SRTM elevation data analyzed in cross section view, and observed non-bankfull depths came from field campaigns. The SRTM bankfull widths for RN ranged from 2309m to 3349m, within -120% of DHG predicted widths and 1872m to 3191m, within 37% of DHG predicted widths for the RS. The DHG XS areas of 30,521m2 at RN and 152,837m2 at RS were divided by the SRTM bankfull widths to yield SRTM bankfull depths of 11m at RN and 63m at RS, which were within 56% and -38% of DHG depths. To convert to non-bankfull depths a ratio of discharge was used, 75,532m3/s of non-bankfull average flow during the field campaign, to 135,361m3/s of averaged

bankfull flow led to 56% percent of bankfull flow. This suggests we can adjust SRTM depths to match non-bankfull conditions. These steps can be utilized to establish a method to predict hydraulic complexity at several Amazon confluences without velocity observations.

Level of research: Graduate - M.S.

Department: ERE

Faculty Advisor: Ted Endreny

Authors: Kroll, C.N. Departments of Environmental Science and Environmental Resources and Forest Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: The Bronx River Watershed

Abstract: The Bronx River in New York City, NY flows southward from Weschester County, through the Bronx, and into the East River. In its headwaters is the Kensico Dam and associated reservoir, which serves as a drinking water supply for the surrounding area. The over next 21 miles the Bronx River drops 350 feet until it reaches sea level, where it continues for another 2.5 miles as a tidally influenced estuary. The Bronx River was originally a healthy, diverse ecosystem. However, human activity over the last two centuries has altered the watershed, resulting in major ecosystem degradation. Drivers of this degradation include disturbed hydrology, storm water runoff, combined sewer overflows (CSOs), aging infrastructure, invasive vegetation, and degraded habitat. In the 1970's efforts began to cleanup and restore the Bronx River, and progress has been made. Parks and greenways have been established, serving as riparian buffers and preventing further river-side development. While some storm water runoff, industrial pollution, and CSOs have been abated, there is still more work to be done. The Bronx River is rated as a Class I watershed, and the lower portion of the river is not safe for swimming (only fishing and secondary contact). Efforts to green New York City, including the MillionTreesNYC initiative, have improved the function of this watershed. This study examines the current ecosystem benefits of this watershed, and examines ways to improve watershed form and function to increase these benefits in the future.

Level of research: Graduate - M.S.

Department: ERE

Faculty Advisor: Chuck Kroll

Authors: Sabitov, T.Y. Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Study of the impact of climate variability over 50 years on the formation of the landscape and water supply at the Northern ridges of Tien Shan mountains: Case study of watershed in Central Asia

Abstract: Today, scientists all over the world are intensively using remote sensing techniques. Especially those, who study the "coverage" type datasets and widely use remote sensing in the research as an analytic tool. There are numerous researchers that have developed many applications of remote sensing to study environmental issues and particularly environmental processes in mountain regions: snow coverage, glaciers, glacial lakes, grazing and habitat. Recent research's has indicated changes in the alpine environment over the last 50 years: a) changes in the condition of glaciers; b) contribution of glacier meltwater to river flow; c) changes in number, area and capacity of glacial lakes in various regions of the world; d) frequency of upstream catastrophic events; e) lands available for rain-fed agriculture. However, there is little research being conducted to relate these processes due to difficulties of access to remote locations, data exchange and relatively lack of historic remote sensing information. In the last decade access to remote sensing and its implementation to the study of various fields significantly improved, particularly environment based remote sensing. This research has an aim to reveal these changes and show relashionships of these processes.

Level of research: Graduate - M.S.

Department: ERE

Faculty Advisor: Cornelius Neil Murphy

Authors: Abdi, R., Endreny, T.A. Departments of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Balancing the energy budget in a river in order to simulate heat pollution and the benefits of shade from riparian vegetation

Abstract: Warm season river temperature decreases dissolved oxygen and increases animal respiration and is a principal cause of ecological stress, but tree shading from solar radiation and evapotranspiration can reduce this heat stress. This research developed the i-Tree Cool River model to predict the relative impact of riparian shade and evapotranspiration on the energy budget of Mercer Creek, Washington during July 5-14, 2012, in order to determine if more riparian cover can restore river health. The energy budget was based on the Heat Source Model of accounting for heat from long and short wave radiation, ground heat flux, and tributary flows and was modified to include a riparian shade function and an upstream heat source function based on regional air temperature. Field monitoring was used to capture fluctuations in river temperature and weather data, as well as river geometry. The model simulated the

base case scenario of existing conditions, tree height at 10 m, to establish its predictive accuracy and then simulated changes in tree height to examine impacts on the energy budget. The model was able to represent the observed river temperature, and determined that direct radiation onto the river decreased by 3% when increasing tree height from 7 to 9 m, and decreased by 2% when increasing tree height from 9 to 10 m. The next steps of the research will examine the relative impact of direct radiation on stream temperature, when compared with other energy terms such as long wave and tributary inflows.

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Ted Endreny

Authors: DeMarco, M., Endreny, T., Fortier, MO. Departments of Environmental Resources Engineering and Forest and Natural Resources Management, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Benefits of trees in reducing the cooling load of buildings

Abstract: The increasing air temperatures from climate change have lead to increased cooling loads and use of air conditioning cooling systems in buildings. The electricity produced for air conditioning generates greenhouse gases and thereby increases ambient air temperature, and the heat waste from the air conditioning increases local air temperature, creating a positive feedback loop. This research addresses two issues, reducing cooling load and reducing greenhouse gas emissions, by examining how trees directly reduce conductive heat transport by shading the building, and indirectly reduce the convective heat transport through evaporative cooling of the outdoor air. The building's cooling load is predicted with a zero order resistance and capacitance heat transfer model, simulating two scenarios, with and without trees around the building. The i-Tree Cool model generates outdoor air temperature inputs for this model. The greenhouse gas emissions benefit is analyzed using a comparative life cycle assessment, to quantify and compare the overall life cycle climate change impacts of an air conditioning unit in each of the two scenarios. A Monte Carlo simulation was run to create a probability distribution of the likely impacts. A sensitivity analysis was then performed to see how sensitive the cooling load is to the resistances and capacitances of the building masses. This sensitivity analysis is very important to show whether or not tree shading is useful to newer homes with better insulation. The future of this research will implement Beer's law and the movement of the sun to further refine the magnitude of solar radiation affecting the cooling load.

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Ted Endreny

Authors: Siqi Li, Lindi Quackenbush

Title: Fusion of airborne Lidar and Landsat in quantifying forest biomass

Abstract: Previous studies have explored traditional regression, geostatistics, and machine learning approaches to estimate above ground biomass (AGB) based on remotely sensed data. However, the performance of these methods has rarely been compared using common study sites, data, and validation methods. This study aims to explore the advantages and drawbacks of different methods that are commonly applied in biomass estimation. Using Lidar and Landsat derived variables, we compared the effectiveness of geographical weighted regression (GWR), regression kriging, random forest and two hybrid methods for AGB estimation. We calculated AGB for individual trees using species-specific allometric equations, and used total AGB at plot level for model development and evaluation. The two hybrid approaches aim to provide advanced biomass estimation methods with high accuracy by combining kriging with GWR and random forest approaches. A series of continuous forest inventory (CFI) plots located in Heiberg Memorial Forest, Tully, NY was used in this study. Validation data not used in training was used to evaluate the performance of the five methods.

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Lindi Quackenbush

Authors: Mountrakis, G. Department of Environmental Resources Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY, 13210.

Title: Quantifying spatiotemporal trends in corn, wheat, and soybean production across the conterminous United States from 1972-2015

Abstract: To address concerns that United States (US) agriculture is shifting north as a result of climate change, the goal of this study was to examine spatiotemporal trends in corn, wheat, and soybean production across the conterminous US (CONUS) from 1972-2015. Annual county production data was obtained from US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) surveys. A modified Mann-Kendall test was used to identify counties with significant upward and downward monotonic trends in production. Sen's slope estimator was then applied to quantify the linear rate of change for significant counties. While the north/south gradient was most prominent for

soybeans, counties with significant downward and upward trends for corn and soybeans were clustered in the Southeast and Midwest, respectively. The upper Midwest has experienced the greatest increase in production for both crops. Although some clustering was evident for wheat, there appeared to be no clear spatial pattern. As this trend is expected to continue in future years, the upper Midwest should be the focus of agriculture-related infrastructure improvements and measures to reduce environmental degradation.

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Giorgos Mountrakis

Authors: Dr. Lindi Quackenbush

Title: Using remote sensing and spatial analysis to assess the trends in riparian vegetation extent and vigor

Abstract: Riparian buffers play a significant role in filtering contamination and maintaining water quality. Under stress from climate change, agricultural practices and urbanization, the extent of buffers in many areas within the Great Lakes Basin is decreasing and will remain under pressure due to continued economic revitalization plans. This project developed a tool for rapid riparian buffer delineation and monitoring based on imagery within Google Earth Engine, a highly-advanced cloud-based platform for performing remote sensing and spatial analysis. As a pilot study, this tool was applied to quantify change in riparian buffer extent and vigor from 2006 to 2015 along the main stem of Genesee River, which flows through western Pennsylvania and New York into Lake Ontario. While this study focused on a small area and short time interval, we aimed to develop a framework that could be expanded beyond the scope of this study to address various temporal and spatial scales and explore the future potential of the approach for riparian buffer modeling. This presentation will also describe the management implications of utilizing such tools.

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Dr. Lindi Quackenbush

Authors: Shahriar S. Heydari and Giorgos Mountrakis, Department of Environmental Resources Engineering, State University of New York College of Environmental Science & Forestry, Syracuse, NY

Title: Effect of classifier selection, reference sample size and scene heterogeneity in per-pixel classification accuracy using 26 Landsat sites

Abstract: We investigated six important classifiers' per-pixel performance over 26 Landsat blocks (six-band) with complete reference information. The tested classifiers included Naïve Bayes (NB), Support Vector Machine (SVM), K-Nearest Neighbor (KNN), Bootstrap-aggregation ensemble of decision trees (BagTE), artificial neural network (ANN) up to 2 hidden layers, and deep neural network (DNN) up to 3 hidden layers. In each case, the best performance was investigated over a broad grid of parameter settings for each classifier.

Our accuracy assessment indicated that, with the exception of NB, all classifiers' overall performance was similar. However, SVM and KNN worked better on classification of edge pixels. Coupled with their relatively low execution times we would recommend them for classifications using Landsat's spectral inputs and Anderson's 11-level classification scheme. Caution should be exercised though as primarily the SVM and secondarily the KNN demonstrated substantial accuracy degradation during the parameter grid search, therefore an exhaustive parameter optimization process is suggested. While the ANN and DNN neural network variants did not perform as well, their performance may have been restricted by the lack of rich contextual information in our simple six band per-pixel input space. Another interesting finding was the quantification of accuracy degradation with respect to edge pixel counts in an image .

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Giorgos Mountrakis

Authors: Sheng Yang and Giorgos Mountrakis, Department of Environmental Resources EngineeringState University of New York College of Environmental Science & Forestry, Syracuse, NY

Title: Forest dynamics in the conterminous U.S. indicate disproportionate attrition in western forests, rural areas and public lands

Abstract: Forests are experiencing significant changes; studying geographic patterns in forests is critical in understanding the impact of forest dynamics to biodiversity, soil erosion, water chemistry and climate. Numerous geographic indicators have been proposed but none supports multi-temporal comparisons at various spatial scales independent of study boundaries while allowing intuitive understanding by non-experts. Few studies have examined forest geographic patterns other than fragmentation; however, other spatial processes of forest dynamics are of equal importance. Here, we study proximity to forest in the continental U.S. over ten years as an indicator of forest landscape transformation. Our findings reveal that within that period the average distance to nearest forest increased by 14%. Furthermore, forest attrition - the complete removal of forest patches - is

considerably higher in the western United States, in rural areas and in public lands. Our mathematical model supports estimation of attrition for a given forest cover. We anticipate that our study will serve as a starting point for future studies on deforestation patterns and it will facilitate changes in forest management policy from local to national scales.

Level of research: Graduate - Ph.D.

Department: ERE

Faculty Advisor: Giorgos Mountrakis

Authors: Harnish, L. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Understanding water source knowledge: A survey of New York State residents

Abstract: This study investigates the relationships between water source knowledge and population characteristics among residents of New York State. Using survey data, we test the hypotheses that water source knowledge as a whole positively correlates with income, education level, political ideology, and other factors. We also explore whether accurate water source knowledge positively correlates with these factors. There are many different attributes that could lead to a person's knowledge and awareness of their water source. Locational factors might play a role. In some regions, for example, water contamination is a constant risk due to lack of natural filtration as water seeps back into the aquifers. Because of this, it is especially important that all of those living in these areas are knowledgeable about their water source. The goal of this research is to explore how some factors may be more strongly linked to water source knowledge, and to consider the implications for receptivity to environmental outreach and watershed education.

Level of research: Graduate - M.S.

Department: ES

Faculty Advisor: Sharon Moran

Authors: Ella R Gray

Title: New York's Changing Forests: Predicting Habitat Suitability Changes For Species Of The Maple-Beech-Birch Forest-Type Group

Abstract: New York State's forests face many challenges, including climate change. Impacts include altering the suitability of species' current habitat and potentially shifting their geographic extent. Species distribution models can be used to predict current or future species ranges using environmental and biotic predictor variables. This study applied species distribution modeling to FIA data to predict how tree species composition across New York State may change under future climate conditions. This study focused on potential shifts for ecologically and economically important tree species. Logistic regression modeling predicted variable changes in habitat suitability of sugar maple, red maple, and yellow birch under all climate change scenarios with areas of large decrease. Black cherry is predicted to be more resilient and maintain more suitable habitat. American beech is predicted to undergo little change in suitable habitat. These results indicate that significant changes may occur within the maple-beech-birch forests of New York State over the coming decades.

Level of research: Graduate - M.S.

Department: FNRM

Faculty Advisor: Eddie Bevilacqua

Authors: Gretchen A. Lasser, Daniel S. Hong, Yang Yang, and Ruth D. Yanai

Title: Effects of Nutrients on Foliar Characteristics of Pin Cherry and American Beech

Abstract: Physical properties of tree leaves can indicate forest health, productivity, and can be used to predict decomposition rates. This study focused on pin cherry (*Prunus pensylvanica*), a common pioneer species throughout the northeastern USA, and American beech (*Fagus grandifolia*) a climax species currently threatened by beech bark disease. Samples were collected in the White Mountain National Forest in New Hampshire in four stands that naturally regenerated following clearcutting 27 to 42 years ago. Beginning in 2011, plots in each stand received no treatment or N (30 kg N/ha/yr as NH4NO3), P (10 kg P/ha/yr as NaH2PO4), N&P, or Ca (1150 kg Ca/ha in the form of CaSiO3 as a one-time addition). Sun-exposed leaves were collected with a 20-gauge shotgun from three trees of each species in each plot in August 2016. We examined specific leaf area (SLA) and leaf dry matter content (LDMC). While no significant effects were found with SLA, a treatment effect was noted with LDMC. In young stands beech showed a lower LDMC due to nitrogen (P= 0.007) and in middle-aged stands pin cherry showed a higher LDMC associated with calcium treatment (P= 0.02). LDMC has been known to correlate positively to leaf lifespan and leaves with high LDMC tend to be tougher and decompose slower, thus assumed to be more resistant to physical hazards like herbivory, wind, or hail.

Level of research: Graduate - M.S.

Department: FNRM

Faculty Advisor: Dr. Ruth Yanai

Authors: Young, A., Miller, E., Villella, J., Emanuels, A., Carey, G., Miller, W., Forestry and Natural Resource Management, State University of New York, College of Environmental Science and Forestry, Syracuse NY 13210. Department of Biology, Baker University, Baldwin City, KS 66006

Title: Nest Guests: Water bears in vole nests in Douglas-fir canopies

Abstract: Tardigrades, more commonly known as water bears are .2-1 mm animals with five body segments and four pairs of legs ending in claws. Although tardigrades live in many environments, their dispersal mechanisms are largely unknown. Here, we study tardigrade communities in nests of red tree voles (*Arborimus longicaudus*) which live exclusively in the canopy of old-growth Douglas-fir (*Pseudotsuga menzeisii*) forests of western Oregon and northwest California. They build nests from conifer needles, twigs, and patches of epiphyte vegetation. We collected 43 nest samples along a longitudinal transect across the range of the red tree vole in southwestern Oregon. A total of 167 tardigrades were extracted with 65% of the samples containing at least one tardigrade. Twelve species of tardigrades were found, seven of which have not been previously reported for Oregon. Inactive nests supported higher tardigrade abundance, but species richness was similar between active and inactive nests. We report a list of tardigrade species found in Oregon and expand the documented species list by 30% (from 23 to 30). Regional precipitation was the strongest driver of tardigrade community composition, followed by nest age, while tree height and diameter were not significant. These results suggest that red tree voles could act as a dispersal vector for tardigrades within forests.

Level of research: Graduate - M.S.

Department: FNRM

Faculty Advisor: Ruth Yanai

UNDERGRADUATE STUDENT ABSTRACTS

Authors: Sarah-Marie Alam El Din, Nicholas Fiore, Ryan Scheel, Atahualpa Pinto, Christopher T. Nomura

Title: Azido-PHAs for Targeted Drug Delivery

Abstract: Polyhydroxyalkanoate copolymers containing azide functional groups (Azido-PHAs) are of interest to our lab due to their potential application in targeted drug delivery systems. Azido-PHA copolymers are chemically tractable via click chemistry, allowing for the addition of an assortment of cell targeting chemical groups, labeling reagents, and/or polymers. In this project we aim to 1) examine, and expand the scope of Lee et al.'s NaOH treatment of short-chain and unreactive PHAs to establish a methodology for the purification and removal of endotoxins, molecules that trigger an immunoinflammatory response in humans, from short-chain and medium-chain copolymers derived from our engineered Gram-negative bacterial strain; 2) develop a procedure for the production of paclitaxel-containing, short-chain and medium-chain Azido-PHA nanoparticles within an effective size range between 50-100 nm; and 3) obtain encapsulation efficiencies of drug-loaded Azido-PHA nanoparticles. Towards these aims, here we report our key, preliminary findings and discuss the pros/cons Azido-PHA copolymers have as materials for the targeted delivery of chemotherapeutics.

Level of research: Undergraduate

Department: Chemistry

Faculty Advisor: Ata Pinto

Authors: Kirschner, A Lundgren,B Nomura,C Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Genetic Complementation of Escherichia coli that is Deficient in 3-Deoxy-D-arabinoheptulosonate 7-phosphate Synthase with PhzC from Pseudomonas aeruginosa

Abstract: Enzymes known as 3-Deoxy-D-arabinoheptulosonate 7-phosphate (DAHP) synthases catalyze the rate-limiting step in the biosynthesis of chorismate. This is a precursor for aromatic amino acids, aromatic vitamins, and some secondary metabolites such as phenazines. Interestingly, the phzC gene of the phenazine-biosynthesis operon in Pseudomonas aeruginosa encodes for a DAHP synthase that is structurally unrelated to DAHP synthases involved in the biosynthesis of aromatic amino acids and vitamins. We therefore decided to determine if phzC does function as a DAHP synthase. To this end, phzC was cloned into a low copy plasmid under the control of a lac promoter. The resulting phzC-plasmid was introduced into an Escherichia coli strain deficient in DAHP synthase activity. As expected, heterologous expression of PhzC restored the growth of the E. coli mutant in defined minimal media, which was not supplemented with aromatic amino acids. In contrast, little or no growth in defined

minimal media was observed for the E. coli mutant harboring empty plasmid. Future goals are to biochemically characterize the phzC protein to determine its enzymatic properties.

Level of research: Undergraduate

Department: Chemistry

Faculty Advisor: Benjamin Lundgren

Authors: Natale, F., Lundgren., B., Nomura, C. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Biosensor Research

Abstract: Whole-cell biosensors can use a reporter gene mechanism to indicate whether or not a target compound is present. In a typical biosensor, the compound of interest interacts specifically with a given transcription factor. This specific interaction causes the transcription factor to bind to a unique DNA sequence that is upstream of a reporter gene such as lacZ (beta-galactosidase) or gfp (green-fluorescent protein). Upon binding to the DNA, the transcription factor activates transcription of the reporter gene. In this study, we generated a series of biosensors consisting of enhanced-yellow fluorescent protein (YEFP) as the reporter gene. The YEFP-encoding gene was fused to several different 5'-regulatory DNA sequences: each transcriptionally regulated by a unique or distinct molecule, including acetaldehyde, acetoin and (R)-3-hydroxybutyrate. To test their functionality, expression of these biosensors was measured in *Pseudomonas aeruginosa*. This bacterium possesses the necessary transcription factors to regulate expression of the biosensors. As expected, the relative fluorescence of each biosensor was higher in cells grown in the presence of the respective molecule. Furthermore, we observed higher RF values of 1747, 1528, 1497, and 1746 for the acetaldehyde-regulated biosensor in cells grown in ethanol, acetoin, ethanolamine and L-threonine respectively, as opposed to an RF value of 1196 for non-biosensor cells, suggesting that acetaldehyde is an intermediate in the catabolism of these compounds. These results imply that an easily cultivatable biosensor can be made with *E. coli*. Also, further research can be conducted using biosensors for transcriptional regulation in biofuel production.

Level of research: Undergraduate

Department: Chemistry

Faculty Advisor: Dr. Benjamin Lundgren

Authors: Shave, J.M., Abrams, N.M. Department of Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Synthesis and characterization of perovskite-type lanthanum titinate and its corresponding oxinitride as a material for photocatalytic water splitting

Abstract: Lanthanum titanate (La2Ti2O7) and its corresponding oxynitride (LaTiO2N) were prepared using either a polymerized complex method followed by a traditional high-temperature conversion via ammonia flow or a low-temperature hydrothermal method with in-situ nitridation using hydrazine. The target compound is a known water-splitting photocatalyst, so a comparative study was done to find an alternative synthetic method that lowers the energy input for synthesis and potentially improves scalability. In a related study, woody biomass was used as a bio-template for La2Ti2O7 and LaTiO2N to explore three-dimensional architecture and changes catalytic surface area. The structure was confirmed using x-ray powder diffraction, thermographic analysis, and scanning electron microscopy. Diffuse reflectance spectroscopy indicated a red-shift upon ammonlysis, consistent with the conversion of the metal oxide to the oxynitride. As nitrogen shifts the bandgap of the target compound into the visible light region, it is presumed to be used in solar photocatalytic water splitting reactions and a potential material for photo-electrochemical hydrogen production.

Level of research: Undergraduate

Department: Chemistry

Faculty Advisor: Dr. Neal Abrams

Authors: Wilhelmsen, Curtis J., Dibble, Theodore S., Chemistry Department, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Bimolecular Reactions of BrHgO• with Atmospheric Volatile Organic Compounds

Abstract: It is commonly known that mercury is a neurotoxin. Mercury is mostly emitted as atomic mercury, Hg(0), which has a lifetime of 0.5-1.0 years with respect to oxidation. This is long enough for local or regional emissions of mercury to be transported around the world, creating a global environmental problem. In the atmosphere, atomic mercury is believed to be oxidized to Hg(II) salts. These Hg(II) salts have both a lower vapor pressure and a higher water solubility than Hg(0), so the rate of oxidation largely limits the rate at which mercury enters ecosystems. The identity of these salts are not known, which severely handicaps efforts to model the global cycling of mercury.

The common oxidant for Hg(0) is atomic bromine which results in the formation of BrHg• and eventually BrHgO•. It was previously determined that BrHgO• is sufficiently stable not to fall apart, so that its atmospheric fate will be determined by further reactions. Prior to this research the reactions

involving BrHgO• had not been studied. This poster presents results of the first studies of reactions of BrHgO• with three atmospherically relevant volatile organic compounds. The reactions are shown below:

$BrHgO\bullet + HCHO \rightarrow BrHgOH + \bullet CHO$ (1)

$BrHgO\bullet + CH3CH3 \rightarrow BrHgOH + CH3CH2\bullet$ (2)

$BrHgO\bullet + CH2{=}CH2 \rightarrow BrHgOCH2CH2\bullet$ (3)

Reactions 1 and 2 are hydrogen-abstraction reactions while reaction 3 is addition to a sp2-hybridized carbon atom.

The methods of this research are rooted in computational chemistry. First, quantum chemistry was used to obtain relevant structures and energies. Rate constants for reactions were then determined using transition state theory.

Due to its low concentration, BrHgOH is not of a health concern but the benefit of this research is the possible discovery of a previously unknown Hg(II) species in the atmosphere. If BrHgOH is found to be produced significantly from hydrogen abstraction, this could be a species to experimentally detect while measuring atmospheric mercury in the atmosphere.

Level of research: Undergraduate

Department: Chemistry

Faculty Advisor: Dr. Theodore S. Dibble

Authors: Alsafadi, O; Fox, KAW; Chang, CT; Alger, KE; Whipps CM

Title: Detection of blood parasites in Wild Turkeys (*Meleagris gallopavo*) in New York State, using molecular techniques.

Abstract: For the last few decades there has been concern that the wild turkey (*Meleagris gallopavo*) population has been declining. This may be due to many factors, but one contributor could be infectious disease. However, little is known about what pathogens occur in wild turkeys or what impact they might have as limiting factors. To investigate this, we tested 180 turkey blood samples for the presence of apicomplexan parasites. Haemosporidians from the genera Leukocytozoon, Haemosporidia, and Plasmodium are known to have impacts on other birds, so these were targeted. Using a general PCR test for these genera, blood samples were evaluated and any positive samples were sent for DNA sequencing. Of the 180 samples evaluated, 57% were found to have haemosporidians. These results do not answer our question to why the wild turkey population has been declining, however, it has indicated that haemosporidians are present, but their role is yet to be determined.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Dr. Chris Whipps

Authors: Amoia M.T., Horton T.R. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: The Effects of the Hemlock Woolly Adelgid on the Ectomycorrhizal fungi associated with **Tsuga canadensis** (Eastern Hemlock) in Central New York

Abstract: Invasive insects pose serious threats to their host tree species as well as the habitat they invade. Intense and sometimes irreversible ecological situations are created with the establishment of invasive insect species. Mycorrhizal fungi have symbiotic relationships with the roots of plants and can be subjected to these impacts in the case of herbivory. The purpose of the study was to understand and document how the impacts from the hemlock woolly adelgid are reducing this relationship, by counting ectomycorrhizal root tips and identifying fungal presence. Soil samples were obtained at four different sites in Central New York, two infested sites and two healthy (control) sites. The results gathered a p-value of 0.111, concluding no significant reduction in the amount of ectomycorrhizal root tips produced in the infested sites. Molecular techniques such as PCR was conducted to allow for DNA sequencing and identification of EM fungi. The fungi present can shed light into the affects this insect is having on this symbiotic relationship. Invasive insects have the potential to negatively impact the tree hosts they become intimately engaged with, as well as negatively impacting the mycorrhizal fungi associated with such trees. Furthermore, they can stress ecological processes and ecosystem functions quite severely, and ultimately affect the interdependence of nature.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Thomas R. Horton

Authors: Carroll, J. Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, Syracuse NY 13210 and The School for Field Studies, Tropical Island Biodiversity Studies, Bocas del Toro Panama

Title: The Effects of Anthropogenic Disturbance on Avian Feeding Guild Distribution in the Bocas del Toro Archipelago, Panama

Abstract: Tropical rainforests are biodiversity hotspots, but their wildlife populations are facing decline as anthropogenic disturbance increases. To understand how to manage these disturbances, the impact that they have on biodiversity needs to be understood. Avian species provide a valuable indication in this type of research due to their wide distribution, diversification, and conspicuousness. Examining feeding guilds specifically and how their distribution changes within different levels of disturbance provides valuable information on the condition of ecosystems and communities as a whole may change with disturbance. Avian surveys were conducted in four sites throughout the Bocas del Toro archipelago (Isla Popa, Isla Solarte, Floating Doctors Preserve and the Institute for Tropical Ecology and Conservation), and the level of human disturbance was recorded at each site. ANOVA/Tukey's tests were conducted and it was found that there was significantly less species within the small vertebrate feeding guild in an area of high human disturbance, and significantly higher overall distribution of the nectar feeding guild in an area of high disturbance. Small vertebrate feeding guild abundance was therefore found to be negatively correlated with human disturbance, and overall nectar feeding guild distribution was found to be positively correlated with human disturbance. Changes in populations and distribution of feeding guilds impacts overall community dynamics, so understanding how avian distribution is affected by human disturbance provides valuable insight on how biotic communities might change with such influence and how this can be mitigated.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: John Farrell

Authors: Christiano, A., Leydet, B.F. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Monitoring phenotypic transition of *borrelia burgdorferi* under normal and nutrient limiting culture conditions

Abstract: *Borrelia burgdorferi*, the agent of Lyme disease, has pleiomorphic capabilities that enable it to change from normal spirochetal form to roundbody and microcolony phenotypes, especially in stressful conditions. The roundbody form of this microbe is most commonly found later in the tick blood meal within the midgut lumen, rather than adhered to the epithelial lining like most other spirochetes. We hypothesize the luminal presence of roundbodies prevent the excretion of cells from the tick during blood meal digestion, aiding in transstadial survival. Given the difficulties of in vivo imaging a tick's midgut, we believe that monitoring genes transcribed specifically by roundbodies will allow detection of these forms during and throughout the blood meal. To mimic conditions experienced by spirochetes during tick feeding, bacterial cells were grown in standard BSK culture media at 23° C, temperature-shifted to 35° C, and cultured in BSK or nutrient limiting media (RPMI) for 6 days. Cells were enumerated

every 24 hours via epi-fluorescent microscopy. Unlike cells in standard culture media (BSK), cells in nutrient deficient RPMI decreased in number over time. Additionally, the percent of roundbodies in RPMI media was higher and increased throughout the experiment when compared to roundbodies in BSK media. Moreover, spirochete numbers decrease significantly in RPMI, while roundbodies gradually increase. These data suggest that unlike the spirochete form, roundbodies are able to persist within nutrient limiting conditions. These growth experiments serve as the foundation for investigating roundbody specific gene expression and their role in the life strategy of the spirochete.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Brian Leydet

Authors: Zachary, A, Davis. Department of Environmental Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Melanie Seiler. School of Biological Sciences, University of Bristol, Bristol, United Kingdom

Title: Do Black-and-White Ruffed Lemur (*Varecia varigata*) Eavesdrop on Alarm Calls?

Abstract: Alarm calls carry anti-predator information which can be detected and acted upon by others. Eavesdropping in communication networks is likely widespread. However, the factors that promote the evolution of this behavior are not always well understood. It has been hypothesized that solitary species have a greater need for eavesdropping than social species. Eavesdropping may also be more likely to occur if the species involved have a degree of predator overlap. I conducted playback experiments to black-and-white ruffed lemurs (*Varecia varigata*), a social species, in Ranomafana National Park, Madagascar to test these hypotheses. I broadcast Madagascar magpie-robin (*Copsychus albospecularis*) alarm calls and songs to the lemurs and observed the immediate response of focal individuals. I found no significant difference between immediate anti-predator and non-antipredator responses. Eavesdropping does not appear to be in the behavioral repertoire of the black-and-white ruffed lemur. Their social nature may eliminate the need to be attentive to heterospecific alarms, as anti-predator information may already be effectively disseminated among conspecifics. Alarm calls from Madagascar magpie-robin may not be cued in on by *Varecia*, but still may from other species with a greater degree of predator overlap. Future studies should use a stimulus species with a larger degree of predator overlap with *Varecia* in order to account for this possible influence.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Bill Shields

Authors: Kyle S. Feldman, Zaara Sarwar, and Christopher T. Nomura, Department of Chemistry, State University of New York – College of Environmental Science and Forestry, USA

Title: Characterization of the SfnR1 and SfnR2 Enhancer Binding Proteins that Regulate Sulfur Metabolism in *Pseudomonas aeruginosa* PAO1.

Abstract: Methanesulfonate serves as a source of sulfur for biochemical reactions in aerobic cells. Methanesulfonate utilization in *Pseudomonas aeruginosa* PAO1 has been attributed to a three gene operon, msuEDC, which codes for the sulfate starvation-induced system. It is not currently known how the expression of the msuEDC operon is regulated. We hypothesized that the SfnR1 and SfnR2 genes, which are located adjacent to the msuEDC operon, have a role in the regulation of the msuEDC operon. Sequence analysis shows that both genes encode RpoN associated transcriptional regulators. Likewise, a RpoN promoter is present in front of the msu operon. In an effort to obtain a better understanding of the role of the SfnR1 and SfnR2 transcriptional factors in methanesulfonate metabolism, we used sequence analysis and electrophoretic mobility shift assays (EMSAs) to identify their target genes. EMSAs showed that both SfnR1 and SfnR2 bind specifically to the msuEDC promoter region. Sequence analysis of the msu promoter region revealed an 18-bp consensus sequence (CTGTTGC-N2-GG-N3-ACAG) upstream of the RpoN binding site that could be the binding site of SfnR2. This same consensus sequence was also found upstream of the sulfonate metabolism genes SfnA (PA2346) and SfnG (PA3954). Future research will focus on characterizing these potential targets of SfnR1 and SfnR2.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Zaara Sarwar

Authors: Gervascio, T.A., Rundell R.J. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Dating the terrestrial invasion of the Cyclophoroidea (Mollusca: *Gastropoda*) using the Fossilized Birth-Death model.

Abstract: Despite their vast diversity, few metazoan lineages have made the transition from marine to terrestrial habitats. These transitions must have been accompanied by dramatic shifts in the physiology and ecology of the lineages, marking major evolutionary events that shaped the diversity we see today. Among the Metazoa, gastropod molluscs have likely been the most successful, comprising at least 12 separate transitions. This makes them particularly suitable for studying the evolutionary context of

these major events. The terrestrial *Cyclophoroidea* contain some of the most spectacular shell morphologies in the *Gastropoda*, but lack clear morphological synapomorphies. Recent phylogenetic studies have proposed the monophyly of this group, which suggests a single ancestral colonization of land. Fossils from 100 million year old Burmese amber assigned to families in the *Cyclophoroidea* suggest that this transition to terrestriality was the earliest in the *Gastropoda*. Here, we test the monophyly of the *Cyclophoroidea* and estimate the age when they diverged from their marine sister group using newly available evolutionary methods. The development of new relaxed molecular clock methods for seamlessly integrating molecular and fossil data provide exciting new possibilities for determining the timing of these evolutionary events. We use the Fossilized Birth-Death model in a Bayesian framework implemented in BEAST v. 2.4 to date the phylogeny. Our analyses support the monophyly of the *Cyclophoroidea*, confirming that there was likely only one transition to terrestriality in this lineage. Our dating estimates confirm that this clade likely represents the earliest transition to terrestrial habitats of the extant Gastropoda.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Dr. Rebecca Rundell

Authors: Brianne Innusa, Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY, 13210

Dr. Jamie Mirowsky, Assistant Professor, Department of Chemistry, State University of New York

Title: Are Birthday Candles Harming Human Health?

Abstract: Air pollution exists in every aspect of our lives. When we celebrate someone's birthday, we generally aren't thinking about a person's health as they blow out their candles and the cake is cut. Little do we know, that these little celebrations could be impacting our health. If these particles are small enough, particularly PM2.5 – which have a diameter of less than 2 μm, they can penetrate our lungs and cause respiratory and cardiovascular health problems. When a group of birthday candles are blown out they release combustion particulates into the air, similar to those emitted from a truck or car. For this experiment, particulate concentration was measured before and after 18, 12, or 6 candles were blown out using Airbeams – a low-cost air pollution sensor. In addition, two Airbeams were placed at different heights and distances to assess how particulate concentrations vary with height. It was found that the particulate concentration drastically increased at taller heights than those close to the ground. Also, it was observed that the number of candles is directly proportional to the amount of particulates. Trials with 18 candles had peaks around 120 μg/m3, this is equivalent to the ambient air pollution found in China. Trials with 6 candles had peaks around 60 μg/m3, and this concentration could easily be found

in a NYC subway. This study shows, that we should be mindful of the of the particulates we release when using candles as they may be detrimental to our health.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Dr. Jamie Mirowsky

Authors: Anish Kirtane, Dr.Hyatt Green, Dr. Svetsolava Todorova

Title: Microbial Mercury Methylation in Fayetteville Green Lake, NY

Abstract: Anthropogenic deposition of mercury (hg) in the environment increased over time. Most of this mercury is in its elemental form (Hg0), but the methylated form, methylmercury (MeHg) is a potent neurotoxin that readily bioaccumulates and is responsible for thousands of health advisories. In nature, the anaerobic activities of sulfate reducing bacteria (SRB) are the major source of MeHg. Fayetteville Green Lake (FGL), NY is a meromictic lake with high sulfate concentrations (12-16nM) and an anoxic zone below 18-20m of depth, which makes FGL an ideal study site for studying the mercury methylation process of SRB. Samples were collected at 3m depth intervals and filtered. DNA was extracted and analyzed with quantitative polymerase chain reaction (qPCR) using four previously published primer sets targeting mercury methylation genes (hgcAB) from Delta-proteobacteria, Firmicutes, Archaea, and all prokaryotes ("universal"). Using the universal assay we found the highest concentration of hgcAB genes at the chemocline. Interestingly, the same assay revealed detectable concentrations of hgcAB in the oxic zone of the lake which has not been observed in previous studies. The delta-proteobacteria clade specific hcgAB qPCR assay indicated detectable concentrations only in the anoxic zone where the SRB dominate. Firmicutes and Archaeal hgcAB genes were not detected throughout the water column. The MeHg concentrations were in agreement with the genetic data. Chemical analysis of total mercury would bolster the understanding of this transformation.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Hyatt Green

Authors: Alyssa Lau, Jesse Czekanski-Moir, Teresa Rose Osborne, David Bullis, Rebecca Rundell (PI), Department of Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Synonymous and nonsynonymous substitution ratios (dN/dS) associated with habitat transitions in the *Gastropoda*

Abstract: COI (Cytochrome Oxidase I) is a commonly sequenced gene region that is used to investigate the evolutionary history and species boundaries of many eukaryotic lineages. Despite the fact that COI is one of the most frequently sequenced gene regions, we still do not fully understand the extent to which its evolution is driven by natural selection in different habitat types. We will be using marine and terrestrial gastropods as a model system for this study. There are over 20,000 species of gastropods in each habitat, but their transition from marine to terrestrial habitats has only occurred 10-20 times. This is a larger number of transitions than in any other metazoan class, so the *Gastropoda* is an ideal taxon for investigating selective pressures associated with this major habitat transition. We use the synonymous and nonsynonymous (dN/dS) substitution ratio of the COI gene as an indicator for directional selection in marine and terrestrial gastropods. We hypothesize that the dN/dS ratio is higher when comparing closely-related marine and terrestrial lineages of gastropods due to physiological challenges associated with this major habitat transition. COI sequences were obtained from GenBank and aligned and analyzed in MEGA (Molecular Evolutionary Genetics Analysis). We constructed several 3-4 taxon phylogenies that included only marine taxa, terrestrial taxa, or a combination of both taxa that are closely related to one another. The dN/dS ratios were also calculated using MEGA. We demonstrate the potential for using COI as a tool for understanding molecular evolution in juxtaposition with macroevolution. This approach can further our understanding of factors that affect adaptation and diversification in many metazoan lineages.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Dr. Rebecca Rundell

Authors: Lee, J. Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, Syracuse, NY, 13210. McNulty, S. Associate Director of the SUNY ESF Adirondack Ecological Center, Newcomb, NY, 12582

Title: Comparing the Diversity of Small Mammal Communities across Various Forest Stands in the Adirondack Park

Abstract: Small mammals play important roles in northern forests, and can act as useful bioindicators of ecosystem function. Our study aimed to determine how small mammal communities differ across forest stands of various ages, as well as how other factors, including leaf litter depth and invertebrate abundance, impact what small mammal taxa may be present. We hypothesized that a greater diversity

of herbivorous small mammals would be present in younger forest stands, and that a greater diversity of carnivorous small mammals would be present in older forest stands. We performed live trapping, recorded leaf litter depth, and performed invertebrate surveys across three sites. In august In August 2016, we compared a white pine stand harvested in 2012, an unmanaged deciduous stand (AD Gate) and a forested power line on the SUNY ESF Huntington Wildlife Forest in the Adirondack Mountains. No significant difference in the diversity of small mammal taxa was observed, although a moderate positive correlation between invertebrate abundance and leaf litter depth was observed. The highest leaf litter depth was observed at the AD Gate area with a depth of 6.57 centimeters, while the Power Line area exhibited the greatest invertebrate abundance with a total of 39 invertebrates observed. These results may indicate that heterogeneity in plant communities may play a larger role in facilitating faunal diversity than forest stand age, and that abundance in small mammal and invertebrate communities may be a more useful indicator of ecosystem function than species diversity in northern forests.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Stacy McNulty

Authors: Lee, L., Weber, J., Leopold, D. J. Department of Environmental Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse NY 13210.

Title: Preliminary Analysis of Germination Rate of Houghton's Goldenrod (*Oligoneuron houghtonii*) in Local Adaptation to Native Substrate Type

Abstract: Houghton's goldenrod (*Oligoneuron houghtonii*) is federally listed as threatened with around 80 populations in the Great Lakes coastal region, found in interdunal wetlands, rocky shorelines, and marl fens. Little is known about its life history requirements. Its seeds and germination are threatened by shoreline modification and an increasingly unpredictable hydrologic regime. Analyzing optimal substrate for germination is critical in prioritizing sites for conservation. Ex situ greenhouse experiments involving seeds collected (with permission) from 27 populations showed that smooth substrates (sand, marl, and soil) had significantly higher germination than rough substrates (litter, moss, and gravel; $p<0.001$). Substrate composition of in situ locations was then visually analyzed and compared to the ex situ germination rates in each population for each experimental substrate. There was a positive correlation between ex situ germination rate on a given substrate and in situ substrate conditions. Success was highest in substrates that matched the ex situ environment, suggesting genetic, local adaptation to germination conditions. However, in situ substrate data were biased toward smooth substrates, possibly leading to a false correlation. Further work is being done to evaluate the significance of substrate on comparing vegetative and reproductive conditions. This preliminary analysis will provide some baseline criteria of optimal sites for management of Houghton's goldenrod.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Donald J. Leopold

Authors: Lewis, J., Chang, C.T., Whipps C.M. Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Tracking Long Term Transmission of Infectious Disease in Laboratory Zebrafish (*Danio rerio*)

Abstract: The zebrafish (*Danio rerio*) is a commonly used model organism for a wide range of research. Infectious diseases can threaten such research, highlighting the importance for maintaining the health of experimental animals to ensure the success of this work. A commonly occurring disease in zebrafish is mycobacteriosis, caused by several species of *Mycobacterium*. In this study we committed to observing how transmission of long term *Mycobacterium chelonae* exposure in zebrafish might occur by bacterial shedding from infected fish. This included qualitatively tracking the occurrence of bacterial transmission from host to biofilm. Individual fish, in three groups of 18, were either exposed through intraperitoneal injection (5.0 x 10^4 cfu) or ingestion of Gelly Belly supplement (5.0 x 10^4 cfu). Individuals were observed over the course of 16 weeks and surface biofilm and feces were collected weekly for testing. In as little as one week, mycobacteria were detectable in the biofilm and feces cultures of the injected fish. They remained abundantly present for 10 weeks before tapering off. The biofilm and feces cultures from the Gelly Belly fish detected mycobacteria inconsistently beginning in week two. The results from culturing suggest that transmission may have occurred via natural shedding and through infiltration of the digestive track by the infection. We aim to use these results to provide one of the first long term studies of *Mycobacterium* transmission in a zebrafish facility. These efforts will add to the ongoing research surrounding these virulent bacteria.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Christopher Whipps

Authors: Lewis, J., D. Kiernan and S.A. McNulty Departments of Environmental & Forest Biology and Forest & Natural Resources Management, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210, Adirondack Ecological Center,

Title: Gladiator Salamanders as Biological Indicators of Climate Change

Abstract: Given their sensitivity to changes in their habitat and strong territoriality, salamanders are considered indicator species for environmental quality and perhaps climate change. We tracked the relationship of four Northeastern terrestrial woodland salamander species (*Desmognathus fuscus*, *Eurycea bislineata, Notophthalmus viridescens* and *Plethodon cinereus*) to precipitation and temperature over 17 years in the central Adirondacks. In moist conditions, salamanders occupying artificial cover objects in mature, largely unmanaged forest were weighed, measured for snout-vent length and vent-tail length and selected invertebrate prey were documented during May and June 1998-2016. We predicted salamander abundance and body size would be positively related to precipitation, temperature and invertebrate prey abundance. Only *Desmognathus fuscus* (Northern Dusky salamander) had a significant relationship ($p = 0.006$) between snout-vent length and precipitation, with wetter conditions relating to larger salamanders. There appears to be a significant interaction ($p = .004$) between individual species abundance and precipitation levels across the four species we studied. While there was no evidence of a relationship between invertebrate abundance and climate variables over time, there was a proportional trend between average temperature and spiders (*Araneae*) and an inverse trend between average temperature and beetles (*Coleoptera*). Therefore we can not confirm that there are more prey types in wet conditions versus moist. By monitoring salamanders, we can better understand why some species (i.e., Northern duskies) may be more sensitive to climate change than others, and what that means for these predators' ecological role in the northeastern forest.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Stacy McNulty

Authors: Morley, M. S., Sosa, C., Yanai, R. Departments of Environmental Forest Biology, Environmental Science, and Forest and Natural Resource Management, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Time for Tea: Effects of Nutrients on Teabag Decomposition after 3-Months Incubation in Northern Hardwood Forest Soil

Abstract: Decomposition of organic material is a key process in nutrient cycling in ecosystems and is influenced by environmental conditions. Climate, litter type, and nutrient availability are factors that contribute to decomposition rates. An international research project spanning 365 sites is implementing a uniform methodology to measuring global rates of decomposition with a bioassay approach using two types of tea. This study examines decomposition of Lipton green and rooibos tea in experimentally fertilized soil in a mixed deciduous forest. In the White Mountains of New Hampshire USA, the Multiple Element Limitations in Northern Hardwood Ecosystems Project has added nitrogen, phosphorus, both nitrogen and phosphorus, and calcium across three experimental sites: Bartlett, Hubbard Brook and

Jeffers Brook. Teabags were installed 3-13 cm into the organic layer in two stands (mid-aged and old) at each site for 3 months. After incubation, mass loss was analyzed with a randomized complete block design analysis of variance in SAS. We observed delayed decomposition of rooibos tea in plots treated with N and P ($p = 0.06$). Green tea decomposition was not influenced by treatment ($p = 0.77$). In addition, green tea in old stands decomposed more than in mid-age stands ($p = 0.01$) while rooibos tea was not affected by stand age ($p = 0.34$). These findings are early evidence of nutrient influence on organic material decomposition. Additional teabags will be collected after 1, 2, and 3 years, and the results will be combined with the results of the global experiment to further our understanding of decomposition.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Ruth Yanai

Authors: Motwani, Siddharth; Farrell, John; Augustyn, Ericka - Department of Environmental and Forest Biology, SUNY-ESF, NY 13210

Title: Determining Factors of Piscivorous Insect Catch in Wetlands of French Creek, NY

Abstract: Piscivorous insects in wetlands are an understudied aspect of larval fish recruitment. Wetlands of French Creek Wildlife Management Area (Jefferson County, NY) are used by sport fish like Northern Pike and Largemouth Bass as nurseries, so the presence of piscivorous insects is important when stocking fry. We sought to analyze catch as a function of five different abiotic variables in four categories of piscivorous insects: Anisopterans, Belostomatids, *Ranatra spp*., and Notonectids. Individuals were collected from fry traps in 16 different wetland complexes over the course of 18 days. Wetlands were differentiated by mean temperature, chlorophyll a concentration, river mile, area, and treatment. An AIC was carried out in RStudio to determine the explanatory variable for each insect and an ANOVA was carried out on the model determined best by the AIC. Mean temperature was the variable most associated with Anisopterans, with a p-value of 4.897e-5. Area was the variable most associated with Belostomatids, with a p-value of .01303. Treatment was the variable most associated with Ranatra spp, with a p-value of .1381. All the variables were determined to be related to Notonectid catch, but resulted in a p-value of .4311. It is interesting that 3 of the 4 insects had different determining variables for catch. This poses a problem when stocking due to how these variables interact with each other; a large area wetland will take longer to warm, reducing mean temperature. Due to the proximity of farmlands, analyzing nutrient loads may give additional insight to piscivorous insect catch.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Dr. John Farrell

Authors: Eddy, M., Livingston, E., Ferreira, M., Schoelkopf, J.

Title: Comparison of five Adirondack moss genera for efficacy as menstruation and diapering materials

Abstract: The accumulation of Traditional Ecological Knowledge (TEK) by indigenous people has led to a wide array of ethnobotanical innovations, including the use of mosses for diapers and menstrual pads. Sphagnum moss is abundant in the Adirondack region and, according to ethnobotanical literature, was widely harvested by indigenous individuals for its insulating and absorbent properties. This study compared heat retention, water-holding capacity, and debris content in five abundant local moss genera. It was hypothesized that *Sphagnum*, relative to the other genera, would contain the least amount of debris (g), have the highest water holding capacity (mL), and show the slowest rate of heat loss (°C/min). *Sphagnum* and *Leucobryum* contained the least debris (g), and retained the most water (mL). Trials for heat retention are still in progress. This data supports that *Sphagnum* and *Leuocobryum* would be the most effective for use as diapering material.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Dr. Robin Kimmerer

Authors: Leydet, B.F.

Title: Quantifying *Borrelia burgdorferi* biofilm formation in vitro

Abstract: The purpose of this study was to analyze in vitro biofilm formation of the spirochete *Borrelia burgdorferi*, the predominant causal agent of Lyme disease in North America. The spirochete is known to form aggregates, or biofilms, that are closely associated with basement membrane epithelial cells in the midgut of the Ixodes scapularis tick. We hypothesize that biofilms play a role in the spirochete's ability to exit the basement membrane, which is essential in transmission to a host. During a tick blood meal, the imbibing of warm host blood changes the spirochete's environment in the tick midgut. To mimic these changes, we temperature shifted bacterial cultures from 23^{o}C to 35^{o}C. Using dark-field and fluorescent microscopy we monitored biofilm formation every 24 hours over five days. We found that the quantity of small biofilms increased as spirochete density increased up to day four. The quantity of medium biofilms increased on day three, and stayed consistent for the remainder of the experiment. Large biofilms were more variable in their quantities. We used the the Leica Application Suite X software

to quantify the area of individual biofilms every 24 hours over a five day period to determine and compare the mean area of different sized biofilms. These in vitro experiments lay the foundation for identifying genes associated with biofilm formation, ultimately allowing us to track aggregate growth in the tick. Because biofilm formation is the first step in *Borrelia* transmission, understanding and manipulating this process may lead to advances in Lyme disease control.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Brian Leydet

Authors: Korbas, S., Stover, C., Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: First Look at the Fish Community of a Highly Disturbed, Urban Watershed in Syracuse, NY

Abstract: The Meadowbrook Retention Basin, Syracuse, NY was created in 1974, after downpours caused repeated flooding events throughout neighborhoods along the stream. Until this past year, there was not any biological data on the fish species that inhabit this watershed. That changed in the summer of 2016 when the SUNY-ESF Chapter of the American Fisheries Society began sampling the watershed as the start to a long term data set. Minnow traps, emmigration traps, and electroshocking were used at three different sites varying in physical characteristics within the Meadowbrook watershed. Analytical steps taken regarding the fish collected include diversity indices such as Shannon-Weiner Diversity and effective number of species, richness values, and length frequency analysis. Eleven different fish species were sampled and Shannon-Weiner Diversity indices of 1.51, .87, and 1.1 were calculated for each of the sample sites. This data set can be the start of a long-term monitoring program on the Meadowbrook watershed and a platform for future studies as we begin to better understand the fish community of an urban setting in Syracuse, NY. Future research could entail monitoring for invasive species regarding the watershed's connection to surrounding waterways in Central New York such as Oneida Lake and research into the population structure of the fish community within the Meadowbrook watershed.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Karin Limburg

Authors: Weinstein, I., Whipps, C., Fierke, M. Department of Environment and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Establishing host-parasitoid linkages among *Sirex noctilio, Sirex nigricornis*, and native Hymenopteran parasitoids using genetic markers

Abstract: *Sirex noctilio* F. (Hymenoptera:*Siricidae*) is an invasive xylophagous woodwasp native to Eurasia introduced to North America. Introduction of this invader in the southern hemisphere resulted in widespread economic damage of the pine industry, however, it is apparently exerting less harm to North American forests. This is possibly due to the presence of native parasitoids that attack *S. noctilio*. The purpose of this study was to identify parasitoids of *S. noctilio*, and the native Sirex nigricornis based on DNA sequence analysis of larvae using cytochrome oxidase I, cytochrome b, and ribosomal large subunit. These sequences were used to evaluate sequence diversity within each genus and species, and examine spatial distributions of genotypes and host-specificity. Specimens were collected from sites in PA and NY. Parasitoid larvae were identified as either Ibalia species or rhyssines (Ichneumonidae: *Rhyssinae*) based on size, mandible morphology, and body structure. Sequence diversity was analyzed and specimens assigned to genera and a letter designating sequence type: Ibalia A-H, Pseudorhyssa A&B, A-C, and Rhyssa A-E. Interestingly, Rhyssa B was the only sequence type found in our native siricid, S. nigricornis, while all other genotypes were found only in *S. noctilio*. There was no pattern of site specificity for the species types in this study, suggesting parasitoids were not isolated to certain locations. Because several sequence types exhibited host specificity to *S. noctilio*, it appears biocontrol of this invasive woodwasp is already occurring on the landscape by several species.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Christopher Whipps

Authors: Julia Williamson, Alice Fox, Jacqueline L. Frair, Christopher M. Whipps, SUNY-ESF, State University of New York College of Environmental Science and Forestry, Department of Environmental and Forest Biology, 1 Forestry Drive, Syracuse, NY 13210 USA

Title: Developing an Effective Method to Determine the Presence of *Neospora caninum*

Abstract: *Neospora caninum* is an obligate intercellular protozoan that has been found to cause spontaneous abortions in cattle. The infectious stage of the parasite, the oocysts, can be found in canid scat. Ruminants and other herbivores become infected when sporulated oocysts in the environment are ingested through contaminated food and/or water. Diagnosis in cattle or other intermediate hosts is difficult, but oocysts can be detected in canid scat samples using molecular based methods. In this study, we focused on creating an effective method to detect and definitively determine the presence of

N. caninum in extracted fecal DNA from canids in Fort Drum, New York, to understand the potential distribution and risk of the parasite where moose occur. For our study, we used the following primers: Np6+/Np21+ and Np7/Np10, which target the Nc5 gene; and JS4/Tim11 which targets the ITS-1. Based on current results, all primer sets appear to work with the scat samples effectively, although the results from each sample are not the same for every primer pair. By screening for the parasite in canid scat samples with polymerase chain reaction, distribution of the parasite and potential risk of exposure for wildlife and domestic animals can be evaluated.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Christopher Whipps

Authors: Michael Tessler, Mark E Siddall, Sackler Institute of Genomics, American Museum of Natural History, New York, NY 10024

Department of Invertebrate Zoology, Richard Gilder Graduate School, AMNH, New York, NY 10024

Title: Collecting, Optimizing and Creating a Cophylogeny for the Shipworms (*Teredinidae*) and their Bacterial Endosymbionts

Abstract: The *Teredinidae* family, more commonly known as shipworm, are bivalves that live in marine or brackish waters. The most defining morphological features are the shells at the anterior end of the marine organism and the pallets at the posterior end. It is often possible to differentiate genera from these traits but much more difficult to tease out species. The purpose of this work was to extrapolate upon the phylogenetic tree already present using molecular techniques and corroborate this data with genetic sequences received from the common endosymbiont of the *Teredinidae* family, *Teredinerbacter turnerae*. A cophylogeny of the two organisms is necessary to fully understand either organism separately. Determining if the endosymbiotic relationship is in the process of coevolution is one way in which the species of the family can be further defined. The Cox1 dataset was more than tripled for the teredinidae family. Eight possibly unidentified species were observed as well as six previously identified. Using RecA a rooted tree was developed for *Teredinibacter turnerae*. Three well-supported clades were found, only two of which were previously documented. One of the three clades aligned well with one clade of the *Teredinidae* family maximum likelihood tree using Cox1.

Level of research: Undergraduate

Department: EFB

Faculty Advisor: Lee Newman

Authors: Jordan M. C'Dealva-Lenik and Lee A. Newman. Division of Environmental Science, State University of New York College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Expression of oxidative stress regulators by plants used as vegetative noise barriers upon exposure to road transport anthropophony

Abstract: Recently, noise pollution has been recognized as a profound global issue with serious consequences for ecological, human, and animal health. Research on noise pollution health impacts is sorely lacking for plants due to the centuries-long, now unfounded belief that plants cannot perceive sound. Li et al. (2008) were the first to document a health impact of noise on plants, noting expression of oxidative stress regulators to combat reactive oxygen species (ROS) generation in plant cells. This study aimed to expand upon Li et al.'s study by observing antioxidant expression in plants exposed to environmentally-relevant sounds. Anthropophony (human-generated sounds) is the major cause of noise pollution, particularly road transport anthropophony (RTA) from vehicles and traffic congestion. Two plant species, *Buxus microphylla* (Wintergreen boxwood) and *Juniperus squamata* (Flaky juniper), were selected based on their use as vegetative barriers to control RTA. A field recording of RTA and corresponding sound level measurements were taken alongside the U.S. 101 freeway in Woodland Hills, CA. This recording was looped to exposed plants through a studio monitor at 73.5 dBA (±1%) for 24 hours in a soundproof room. Control plants were left in silence in the soundproof room for 24 hours. Leaf tissue harvested will be analyzed via colorimetric UV/Vis spectrophotometry for three antioxidants: anthocyanins, proline, and total phenols. It is hypothesized that plants exposed to RTA would express higher antioxidant levels than non-exposed plants, and that there would be differential antioxidant expression in exposed plants between species, but not in exposed plants within a species.

Level of research: Undergraduate

Department: Environmental Science

Faculty Advisor: Lee Newman

Authors: McGowan, K., Mao, H., Zhou, Y., McGlynn, D., Departments of Environmental Science and Chemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210. Hall, C. TRC Environmental, Albuquerque, NM 87109.

Title: Identification and Characterization of a Potential Crematorium Mercury Emission Source

Abstract: Mercury is emitted into the atmosphere from many sources including fossil fuel combustions, incineration, landfill, and cremation processes, among which cremation processes are currently

unaccounted for in the United States Environmental Protection Agency's National Emissions Inventory. The objective of this study was to characterize the temporal variation of total gaseous mercury (TGM) concentrations and identify an unknown, seemingly highly localized source for very high TGM concentrations occurring episodically. TGM measurements were conducted from the State University of New York College of Environmental Science and Forestry campus in downtown Syracuse, New York during the time period of summer 2013 – fall 2015. A complete annual cycle was observed, lowest concentrations (1.395ngm-3) in September, and highest (1.573ngm-3) in January, with an annual average amplitude of 0.178ngm-3. Concentrations appeared to be decreasing continuously throughout the study period, with decreases of 0.12ngm-3 and 0.18 ngm-3 for summer 2013-2014 and 2014-2015, respectively, 0.14ngm-3 and 0.05ngm-3 for fall 2013-2014 and 2014-2015, respectively, and 0.08 ngm-3 for winter 2014-2015. Diurnal cycles were observed with daily maximums at 13:00-16:00 UTC (1.55ngm-3 - 1.65ngm-3) in Winter-Spring, 1:00 UTC (1.4ngm-3 – 1.7ngm-3) and 12:00-16:00 UTC (1.3ngm-3 – 1.52ngm-3) in Summer-Fall. The concentrations above the seasonal 99th percentile values under calm (< 2ms-1) and southeasterly wind conditions were associated with probable Hg emissions from a nearby crematorium, located approximately 890 meters away to the Southeast of the monitoring station. The total emission of mercury from combustion of Hg-containing silver amalgam teeth fillings were estimated to be 0.509lb, 1.64lb, and 0.494lb for 2013, 2014, and 2015, respectively. These were compared to the source strengths documented in the EPA's National Emissions Inventory, including the Syracuse Steam Station (0.3 lb), Onondaga Co Resource Recovery Facility (7.7 lb) and Bristol-Myer Squibb Company (9.52E-02 lb). Further study is warranted to determine the extent of mercury emissions from crematoriums across the United States.

Level of research: Undergraduate

Department: Environmental Science

Faculty Advisor: Huiting Mao

Authors: Paetow, Olivia 1 & Paterson, Gordon 2

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2 Biological Sciences Department, Michigan Technological University, Houghton

Title: An Analysis of C13 and N15 Fluctuations between a Boat Launch, Marina, and Stream Inlet of Skaneateles Lake, NY

Abstract: Carbon and nitrogen are important elements in aquatic systems. Quagga mussels filter water daily, accumulating carbon and nitrogen isotopes in their tissue. These isotopes can be studied to determine trophic position of aquatic organisms as well as the zone of the lake that they inhabit. This

experiment was an analysis of quagga mussel tissue from Skaneateles Lake, NY to gain a better understanding of whether carbon and nitrogen isotopes vary within the lake. Nine samples of quagga mussels were collected with a ponar grab near a boat launch, a stream inlet, and a marina. The mussel tissue was oven dried, homogenized within each sample, and analyzed on a gas chromatograph using mass spectrometry. Half of the samples were lipid-extracted. It was expected that nitrogen and carbon isotopes wouldn't vary greatly between the three locations because all mussel samples were taken from similar depths within the lake and at the same trophic level. This hypothesis was supported by the data. This result indicates that there is a stable baseline of carbon and nitrogen isotopes in Skaneateles Lake which doesn't fluctuate depending on location, indicating that there is little human influence on the water chemistry within the lake. In addition, there wasn't a substantial difference between the results of the lipid-extracted and non-lipid-extracted methods, indicating that it may not be necessary to perform lipid extraction when determining stable isotopes from mussel tissue.

Level of research: Undergraduate

Department: Environmental Science

Faculty Advisor: Ann Moore

Authors: Matthew Purdy, SUNY ESF, Jaime Mirowsky, PhD, Department of Chemistry, SUNY ESF

Title: Project Based Learning Activity Utilizing a Low Cost Particulate Matter Sensor in Environmental Health Education

Abstract: Particulate matter (PM) and noise can have detrimental effects on human health. The effects of particulate matter exposure range from allergic reactions to oxidative stress and tissue damage. Humans are exposed to PM in all aspects of their daily life in both indoor and outdoor environments. Excess noise levels can lead to hearing loss, physiological, and behavioral changes. Sampling allows generalizations about the levels of pollutants in the environment to be made. Sampling is necessary as it is not feasible to sample a location in its entirety. The Airbeam is a low cost sensor that is a direct-read instrument capable of data logging. It is used to measure PM and noise levels. It has the potential to be used in project based learning exercises (PBL) to aid students in gaining a better understanding of sampling methods, spatial variability, data analysis, and hazard identification. Students will create and conduct a sampling plan to determine low and high noise and PM concentrations. After completing the PBL activity, students will form conclusions and present their findings to the class in a PowerPoint presentation.

Level of research: Undergraduate

Department: Environmental Science

Faculty Advisor: Dr. Mirowsky

Authors: Besong, K., Shaw, S. B.

Title: Are our winters changing? Determining if winter temperature and precipitation trends display non-stationarity at varying temporal and spatial scales in Upstate New York.

Abstract: The occurrence of unusually warm recent winters raises the question of whether there has been an observable shift in winter climatology resulting from anthropogenic climate change. In order to explore this question, winter precipitation and temperature trends have been analyzed for non-stationarity from 1950-2017 at varying spatial and temporal scales in the New York region. Station based daily summary data provided by the National Center for Environmental Information National Climate Data Center has been collected and analyzed at local and regional scales. The mean, standard deviation, and variance for winter seasonal (DJFM) and individual monthly values over 5 and 10 year intervals were calculated in order to reveal any climatological shifts since 1950. The emphasis is on Syracuse, NY area and how overall, trends may differ in comparison to the past as well as the region. There is an expectation that more localized, inter-decadal values show greater differences whereas regional, longer term values reveal smaller shifts over the 65-year study.

Level of research: Undergraduate

Department: ERE

Faculty Advisor: Steve Shaw

Authors: Collette Charbonneau, Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Environmental Education Internship at Lime Hollow Nature Center

Abstract: For my senior synthesis project, I interned at Lime Hollow Nature Center in Cortland, NY. From May to August 2016, I assisted staff naturalists with delivering environmental education programs for children ages 3-13: forest preschool, home school, field trips, and summer camp. By working with trained naturalists and educators, I learned how to inspire a child's curiosity and appreciation for the natural world. I participated in a combination of environmental education components, which showed me how children can positively interact with nature and how one nature center can influence so many lives. I utilized my public speaking and leadership skills as well as coursework in communication of science and technology. My general appreciation for nature and my knowledge of Aldo Leopold's Land

Ethic were also useful. This internship taught me how to communicate ecological knowledge to children who already had a basic environmental awareness. As a result, I acquired a new perspective on my future as an environmental professional.

Level of research: Undergraduate

Department: ES

Faculty Advisor: David Sonnenfeld, PhD

Authors: Max Kaczor

Title: My Summer at The Delta Institute

Abstract: My Environmental Studies Senior Synthesis project was an internship with the Delta Institute in Chicago, IL over the summer of 2016. Delta is a nonprofit environmental consulting firm who uses new techniques to disrupt the energy status quo in the Great Lakes Region. I was the communications and marketing intern, where my daily tasks included a group intern project, updating the various social media accounts associated with Delta, updating the website to ensure that it contains accurate information. I also published multiple blog posts with Delta and attended Delta sponsored events where I answered any questions people may have had about the organization and other ways to get involved in the greater Chicago region. During my time at Delta I had the chance network with other environmentalists in the Chicago area including the founder of the "Chicago Climate Exchange", and the head of Goose Island Brewery's: Green Goose campaign. The time I spent at the Delta Institute has given me great exposure to what a professional career in the environmental field would be like, as well as providing me with the necessary skills to continue to progress with a communication oriented career as well.

Level of research: Undergraduate

Department: ES

Faculty Advisor: David Sonnenfeld

Authors: Christiana Kastalek

Title: Naturalist by the Bay

Abstract: This report describes the work conducted during a summer internship along with the relation to coursework and professional development at the WaterFront Center in Oyster Bay, New York. This internship consisted of being a Naturalist teaching campers between the ages of six up until fourteen. Naturalists were responsible for teaching weekly lessons pertaining to but not limited by marine biology, oceanography, and estuary science as well as had to prepare hands on activities such as fishing, kayaking, dredging and arts and crafts. Naturalists taught their campers not only in a classroom setting but outside on the beach, in the water and aboard the Christeen, an oyster sloop and historical landmark. The overall experience was not only to learn more about the marine biology that makes up the waters surrounding Long Island, New York but to enhance interpersonal skills and communication while working in a team like setting.

Level of research: Undergraduate

Department: ES

Faculty Advisor: David Sonnenfeld

Authors: Patterson, R., Goodwin, K., DiRenzo, W., Ives, D., and Woo, T. Departments of Environmental Studies, Sustainable Energy Management, and Environmental Science, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

Title: Reducing Energy Consumption in Walters Hall

Abstract: In cooperation with ESF's Office of Sustainability, the objective of this applied group research project is to reduce electricity consumption in Walters Hall. We had a two-week baseline period where we looked at the average electricity consumption of the building, and now we are in the three-week implementation stage, through April 22, where we are trying to reduce the overall kilowatt hours of electricity used by the building. We've been doing several things to bring about reductions. We replaced many of the building's CFL lights with LEDs instead. Just from replacing bulbs in the 2nd, 3rd, and 4th floor corridors alone, we calculated a savings of $1,158 a year before behavioral changes are made. We've also visited faculty and staff to ask them to make commitments to change their energy use behaviors for the duration of the project, and we have also have been spreading the word to others through flyers, emails, and even tabling in the Gateway Center. We are also using software that gives us real-time and past energy usage in the building, which allows us to track our progress. In the end, we plan on seeing an overall reduction in electricity consumption compared to the baseline period we observed. We'll also make recommendations on how to increase reductions, or on how to maintain the reductions already made.

Level of research: Undergraduate

Department: ES

Faculty Advisor: Dr. David Sonnenfeld

Authors: Russell, A. Department of Environmental Studies, State University of New York, College of Environmental Science and Forestry

Title: Data Technician Experience with FPM Remediations, Inc.

Abstract: To fulfill my senior synthesis project, I participating in a summer internship with FPM Remediations, Inc. FPM is an environmental contract company that works in the public sector with private clients and Air Force bases across the United States. Overall, the internship gave me the opportunity to connect my college learning with real life situations, ultimately sharpening my communications skills. I had the chance to work on any different aspects of the remediation process, including observing meetings and presentations, proof reading documents, and data implementation and organization. Much of what I learned during my time at this internship also applies to what I have learned during my coursework. It also gave me great experience communicating and working with people of differing backgrounds and education levels. My time at FPM was very valuable to my future in communication, I believe that the experience I gained will be valuable to my future endeavors, and help me to be successful.

Level of research: Undergraduate

Department: ES

Faculty Advisor: David Sonnenfeld

Authors: Madelyn Sheehan

Title: Syracuse University Sustainability Management Division Internship

Abstract: My senior synthesis is based on my internship at Syracuse University's Sustainability Management Division. I serve as a sustainability intern conducting various research projects, giving presentations, and creating public outreach materials. The base of my paper reflects on how this internship has prepared me for a career after college as well as how it relates to my education. Classes such as Environmental Impact Analysis has prepared me for the consulting part of my internship while Community Planning and Sustainability has given me the necessary knowledge for the sustainability aspect. My classes and internship have given me a well-rounded portfolio giving me a leg up with employers.

Level of research: Undergraduate

Department: ES

Faculty Advisor: Jack Manno

Authors: Bujanovic, B., Department of Paper and Bioprocess Engineering, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210

Title: Chemical Analysis of Industrial Hemp Species (*Cannabis sativa L*.) Before and After Hot Water Extraction

Abstract: Ever since the first discovery of *Cannabis sativa* in China around 2700 BC, industrial hemp has been used for a wide array of renewable products, textiles, and pharmaceuticals. Hemp's natural fibers have great potential for generating numerous environmentally friendly products that are biodegradable, non-toxic, and carbon neutral. By conducting a chemical analysis of industrial hemp, one can develop a better understanding of its inner workings and generate new ideas on how to extract more useful qualities within the biomass. Both raw hemp and pre-treated hemp (hot water extraction) was analyzed in terms of its cellulose, hemicellulose, lignin, ash, and extractive components. Hot water extraction of the biomass should remove many of the hemicellulose base materials, primarily xylans, allowing the other main constituents to be more accessible to extraction techniques and reactions.

Level of research: Undergraduate

Department: PBE

Faculty Advisor: Biljana Bujanovic